PB83-107342

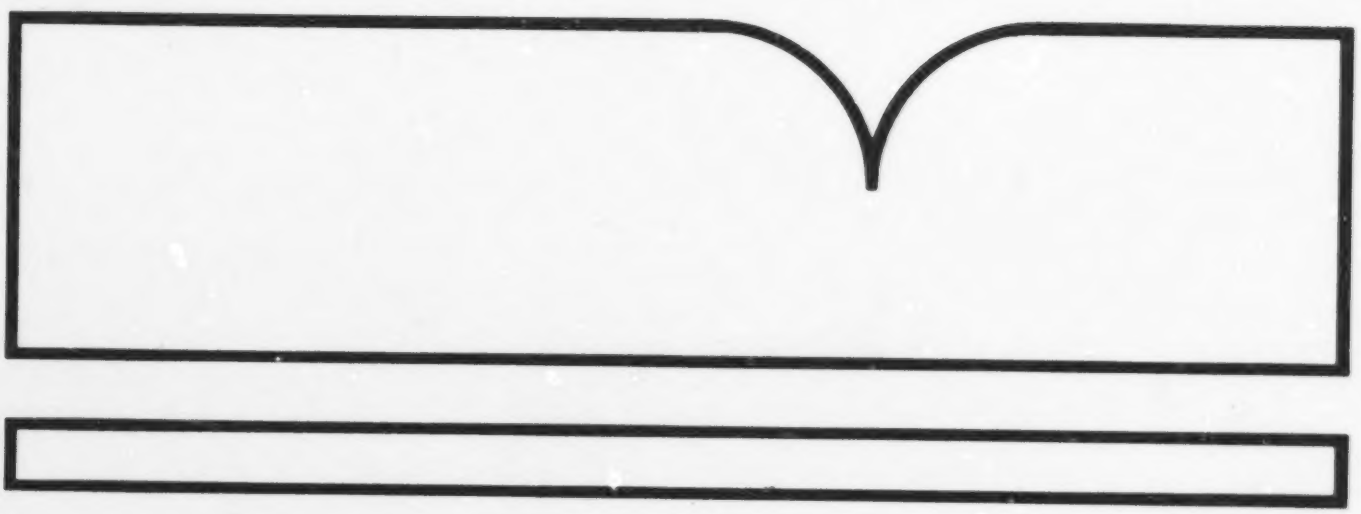
CHAVG - A Program for Computing Averages of Hourly Air Pollutant Concentrations, User's Guide

Aerocomp, Inc.
Costa Mesa, CA

Prepared for

Environmental Sciences Research Lab.
Research Triangle Park, NC

Sep 82



U.S. Department of Commerce
National Technical Information Service
NTIS

PB83-107342

EPA-600/8-82-015
September 1982

CHAVG - A PROGRAM FOR COMPUTING AVERAGES OF HOURLY AIR POLLUTANT CONCENTRATIONS

User's Guide

by

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Contract No. EPA 68-02-3442

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U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

TECHNICAL REPORT DATA (Please read Instructions on the reverse before completing)		
1. REPORT NO. EPA-600/8-82-015	2.	3. RECIPIENT'S ACCESSION NO. PB83 107342
4. TITLE AND SUBTITLE CHAVG - A PROGRAM FOR COMPUTING AVERAGES OF HOURLY AIR POLLUTANT CONCENTRATIONS User's Guide		5. REPORT DATE September 1982 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Joseph A. Catalano and Frank V. Hale		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Aerocomp, Inc. 3303 Harbor Boulevard Costa Mesa, California 92626		10. PROGRAM ELEMENT NO. CDTA1D-04/0275 (FY-82) 11. CONTRACT/GRANT NO. 68-02-3442
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Sciences Research Laboratory--RTP, NC Office of Research and Development U.S. Environmental Protection Agency Research Triangle Park, North Carolina 27711		13. TYPE OF REPORT AND PERIOD COVERED Final 14. SPONSORING AGENCY CODE EPA/600/09
15. SUPPLEMENTARY NOTES		

16. ABSTRACT

CHAVG is a postprocessor program for computing running averages (averages that begin each hour and overlap) and end-to-end averages (averages that do not overlap) from hourly concentration files. Since running averages are greater than or equal to the end-to-end averages, there frequently may be a need to analyze concentration data (from measurement or from air quality simulation models, such as, the UNAMAP series) using both methods of averaging. Calculations are made for selected receptors, and these values are ranked for each of four averaging periods plus a fifth period selected by the user. Output tables are generated for each averaging period for each type of average selected by the user. This document describes the input, processing, and output of the program.

17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
18. DISTRIBUTION STATEMENT RELEASE TO PUBLIC	19. SECURITY CLASS (This Report) UNCLASSIFIED 20. SECURITY CLASS (This page) UNCLASSIFIED	21. NO. OF PAGES 67 22. PRICE

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

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FOREWORD

Within the Office of Air, Land and Water Use, the Environmental Sciences Research Laboratory conducts a research program in the physical sciences to detect, define, and quantify the effects of air pollution on urban, regional, and global atmospheres and the subsequent impact on water quality and land use. This includes research and development programs designed to quantify the relationships between emissions of pollutants from all types of sources, air quality, and atmospheric effects.

The Meteorology and Assessment Division conducts research programs in environmental meteorology to describe the roles and interrelationships of atmospheric processes and airborne pollutants in the effective air, water, and land resource management. Developed air quality simulation models and postprocessors (in the FORTRAN computer language) are made available to dispersion model users in computer-readable form by availability of a magnetic tape from NTIS (see preface).

CHAVG is a data handling processor made available in 1981 for computing running means and end-to-end averages of hourly concentration files. The program provides a state-of-the-art procedure for obtaining the highest second highest short-term concentration of up to five averaging periods.

K. L. Demerjian
Director
Meteorology and Assessment Division

PREFACE

One area of research within the Meteorology and Assessment Division is development, evaluation, validation, and application of models and postprocessors for air quality simulation, photochemistry, and meteorology. The models must be able to describe air quality and atmospheric processes affecting the dispersion of airborne pollutants on scales ranging from local to global. Within the Division, the Environmental Operations Branch adapts and evaluates new and existing meteorological dispersion models and postprocessors, tailors effective programs for recurring user application, and makes these programs available through EPA's UNAMAP system.

CHAVG is an adaptation of the summary calculations of MPTER, which produce the high-five concentration table, with the additional computation of running averages. The program can be activated on hourly concentration output to obtain the various averaging tables without incurring the additional expense of rerunning a model. Although some of the computational methods employed by CHAVG are the same as those employed by some of the more complex models, CHAVG is designed for less costly summarizing of existent hourly concentration data. Furthermore, CHAVG can be used on observed air quality data, provided the data are in a suitable format. In this case, the hourly concentration values are considered averages for an entire hour.

The first two sections of this document are directed to managers and project directors who wish to evaluate the applicability of the postprocessor to their situations. Sections 3 through 6 are directed to engineers, meteorologists, and other scientists who need to know the internal structure of the algorithm. Finally, sections 7 and 8 are directed to persons responsible for implementing and executing the program.

Although attempts are made to thoroughly check computer programs with a wide variety of input data, errors are occasionally found. Revisions may be obtained as they are issued by completing and sending the form on the last page of this guide.

Comments and suggestions regarding this publication should be directed to

Chief, Environmental Operations Branch
Meteorology and Assessment Division (MD-80)
Environmental Protection Agency
Research Triangle Park, NC 27711.

Inquiries regarding use of the program may be made to (919) 541-4564. Users within the Federal Government may call FTS 629-4564. This User's Guide and the computer codes are available from the National Technical Information Service (NTIS), Springfield, VA 22161 (phone number: (703) 487-4763).

ABSTRACT

CHAVG is a postprocessor program for computing running averages (averages that begin each hour and overlap) and end-to-end averages (averages that do not overlap) from hourly concentration files. Since running averages are greater than or equal to the end-to-end averages, there frequently may be need to analyze concentration data (from measurement or from air quality simulation models, such as, the UNAMAP series) using both methods of averaging. Calculations are made for selected receptors, and these values are ranked for each of four averaging periods plus a fifth period selected by the user. Output tables are generated for each averaging period for each type of average selected by the user. This document describes the input, processing, and output of the program.

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ACKNOWLEDGMENTS

The original programs which form the basis for CHAVG were developed by Mr. Thomas E. Pierce, Meteorology and Assessment Division, U. S. Environmental Protection Agency. The authors wish to express their appreciation to Mr. Pierce for this initial contribution and to Mr. D. Bruce Turner for his helpful comments regarding aspects of the work presented here. Support by the Environmental Protection Agency Contract No. 68-02-3442 is also gratefully acknowledged.

SECTION 1

INTRODUCTION

The U. S. Environmental Protection Agency has made available several air quality models through the User's Network for Applied Modeling of Air Pollution (UNAMAP). Within this library of computer programs there are models such as RAM, MPTER, and CRSTER which produce tabular displays of concentration values for several averaging times as well as output files of hourly concentrations at a number of receptors. CHAVG is designed to analyze the hourly files and produce summaries which can then be used to evaluate compliance with the National Ambient Air Quality Standards (NAAQS). Averaging periods of 1, 3, 8, and 24 hours are included in each run, and an additonal averaging period (either 2, 4, 6, or 12 hours) may be specified.

Three types of averages are computed by the program: length of record averages, running averages, and end-to-end averages (also referred to as block averages). A length of record average is a mean concentration over all hours in the input data file. A running average is an average of a fixed number of hours which is computed at each hour; thus, by definition, running averages overlap. Although end-to-end averages also deal with a fixed number of hours, they differ from running averages in that they are not computed at each hour, but bypass a fixed number of hours in order to avoid overlapping.

The UNAMAP models noted above use the end-to-end averaging method to calculate concentrations for the various averaging periods. These calculations are then presented (in tabular form) as part of the hard copy output of the program. CHAVG, a peripheral program, was written to obtain running averages. CHAVG outputs can then be compared with the NAAQS in a similiar manner as ambient monitoring data summaries to obtain a more complete portrayal of the air quality (GCA Corporation, 1974).

Though inherently different, model outputs are treated much like actual observed air quality. When using continuous air quality measurements, the reported hourly value is the result of multiple samplings throughout the hour, each being affected by the meteorology of the moment. Model outputs, on the other hand, are based upon a single meteorological observation--often instantaneous--which may be assumed to represent behavior for the entire hour. This distinction aside, model outputs to be compared with the standards are summarized in much the same way as actual observed air quality.

SECTION 2

DATA-REQUIREMENTS CHECKLIST

CHAVG requires the following input:

- program control information,
- averaging period information,
- location of receptors, and
- hourly concentration data.

The primary input requirement for the program is the file containing hourly concentrations. Models producing this file in the required format are MPTER (Pierce and Turner, 1980) and RAM (Turner and Novak, 1978). Their output can be used directly as input to CHAVG. With extensive modifications, outputs from CRSTER (U. S. Environmental Protection Agency, 1977) and ISC (Bowers et al., 1979) may also be summarized by CHAVG. All of the models mentioned above produce end-to-end averages only.

SECTION 3

BACKGROUND

CHAVG is designed to be consistent with the "Guidelines for Air Quality Monitoring and Data Analysis" (GCA Corporation, 1974) and the "Guidelines for the Interpretation of Air Quality Standards" (U. S. Environmental Protection Agency, 1977) in terms of dispersion model estimates. The guidelines suggest that the highest second highest running average be examined in order to determine compliance with short-term standards.

A discussion of running averages is found in Issue 7A of the "Guidelines for the Interpretation of Air Quality Standards," which states that compliance with the short term standards should be judged on the basis of running averages starting at each clock hour. The computation of end-to-end averages does entail a smaller cost, but running averages may in some cases be preferred.

End-to-end averages are a subset of running averages. This implies that the maximum end-to-end average can at most equal the maximum running average. In practice, however, the maximum end-to-end average is frequently below the maximum running average; the same applies to the second highest value. Figures 1 and 2 illustrate this point: in each case the running averages have maxima greater than those of the end-to-end averages. In the example discussed in Section 6, the highest second highest 3-hour end-to-end average is 779 $\mu g/m^3$ (see Figure 7, page 23), while the highest second highest non-overlapping 3-hour running average is 1366 $\mu g/m^3$ (see Figure 7, page 20)--a significant variation which is due to the difference in the two averaging techniques. Fixed averages provide a representation at the receptors only once for each averaging period. Running averages, on the other hand, provide a representation for each clock hour. This is also seen in Figures 1 and 2. In each case the running averages provide a more detailed representation of the averages at the receptor.

Differences in end-to-end and running averages due to diurnal patterns are dramatized in Figure 3. A hypothetical source, perhaps a gas turbine fired only in the mornings, produces hourly concentrations of 15 units for eight hours each day--from 4 a.m. to noon. The end-to-end averages, ending at 8 a.m., 4 p.m., and midnight indicate that the 8-hour average never exceeds 7.5

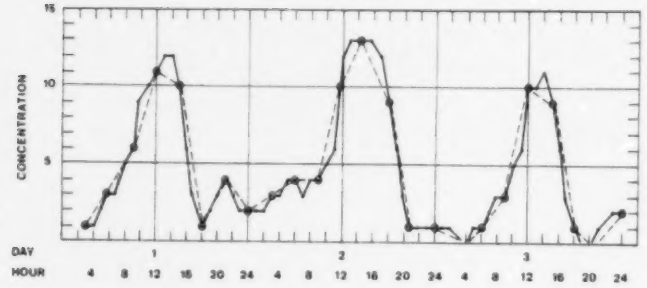


Figure 1. 3-hour running and end-to-end averages.

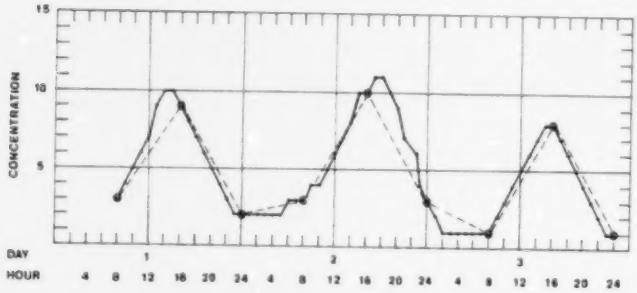


Figure 2. 8-hour running and end-to-end averages.

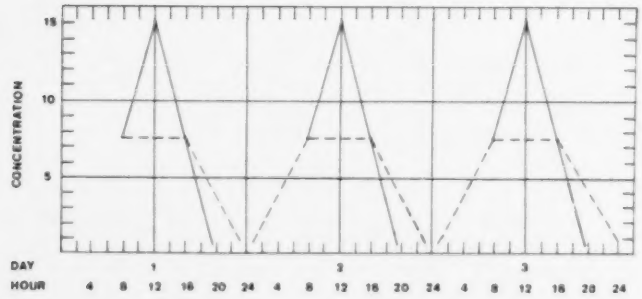
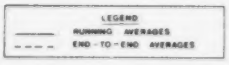


Figure 3. Extreme variation between running and end-to-end averages.



units. Thus, if the standard is 10 units, no violations occur. However, if running averages are employed, it can be seen that exceedances occur each day with 8-hour average concentrations reaching 15 units at noon.

SECTION 4

AVERAGING ALGORITHMS

This section describes the methods used by CHAVG to obtain the different types of averages.

The length of record averages are determined by computing a sum of all of the hourly concentrations for each receptor and dividing this sum by the number of hours. A running average is calculated for each hour. For n-hour averages, every sequence of n hours is summed. For example, the eight hour sum for hour 12 of day 47 would be the sum of the hourly concentrations for hours 5 to 12 of day 47. The sums are ranked, and the top n+1 sums are stored in a table. After all the sums have been computed and ranked, these n+1 sums are divided by n to give the averages.

The use of running averages to determine compliance with specific air quality standards necessitates that the number of values above the standard be evaluated on the basis of non-overlapping time periods. That is, two values above the standard must be distinct and not have any common hours (GCA Corp, 1974). The algorithm used by CHAVG for determining the second highest non-overlapping running average is based on Issue 7B of the "Guidelines for the Interpretation of Air Quality Standards" (U. S. Environmental Protection Agency, 1977). A similar method is used by the data-handling system, SAROAD (Storage And Retrieval Of Aerometric Data) (U. S. Environmental Protection Agency, 1971), adopted by EPA. The second highest average is that average which does not overlap all of the larger averages. For example, given the following 8-hour average concentrations, dates, and times:

Concentration	Hour	Day
29	18	342
28	17	342
28	19	342
27 SH	11	342
26	18	324
26	19	315
26	17	40
25	18	315
25	18	302

the second highest average is 27 at hour 11 on day 342, because it does not overlap with the average ending at hour 19 on day 342 (even though it overlaps with the maximum). Note that by keeping the top n+1 concentrations for an averaging period of n hours, it is guaranteed that one of the n+1 averages will not overlap all of the larger averages.

As noted previously, the end-to-end averages are a subset of the running averages. In particular, the n-hour end-to-end averages are the n-hour running averages which end on hours h such that n divides h. The sums are ranked, and the top five are kept in a table. Since there is no possiblity of overlap among end-to-end averages, the concentration which is ranked second is always the second highest concentration.

SECTION 5

PROGRAM OVERVIEW AND STRUCTURE

This section describes the input, processing, and output of the program.

CHAVG requires a control file and a disk or tape file containing hourly concentrations. The hourly concentrations can be generated by a model such as RAM, MPTER, or CRSTER, or they can consist of observed air quality. Specific formats of these two files are discussed in the section on data input preparation.

During processing, the program computes one sum over all hours for each receptor, and one sum for each averaging period for each receptor. The sums for each averaging period are ranked at each hour as running averages, and at every fixed number of hours as end-to-end averages. As subsets of the running averages, end-to-end averages do not require any additional summation. At the end of the hourly data file, the sum over all hours, when divided by the number of hours, provides the length of record averages, and the running and end-to-end sums are divided by the proper number of hours to give the averages.

CHAVG consists of a main program (CHAVG) and three subroutines (RNRK, RNK5 and OUTRA) which are used by the main program. Figure 4 outlines the processing flow.

Outputs of CHAVG consist of three sets of tables. The first set, composed of a single table, contains the length of record averages. The second set, consisting of one table for each averaging period greater than one hour, contains the running averages. The last set, consisting of one table for each averaging period, contains the end-to-end averages. Figure 5 gives a composite view of the three types of tables.

The length of record table includes the coordinates of each receptor (in user units) and the length of record average concentration in micrograms per cubic meter. The highest length of record average concentration is indicated by an asterisk.

The running average tables vary in size depending upon the averaging period. For an averaging period of n hours, the table contains the n+1 highest average concentrations and the Julian day and hour on which the averages ended. The highest and

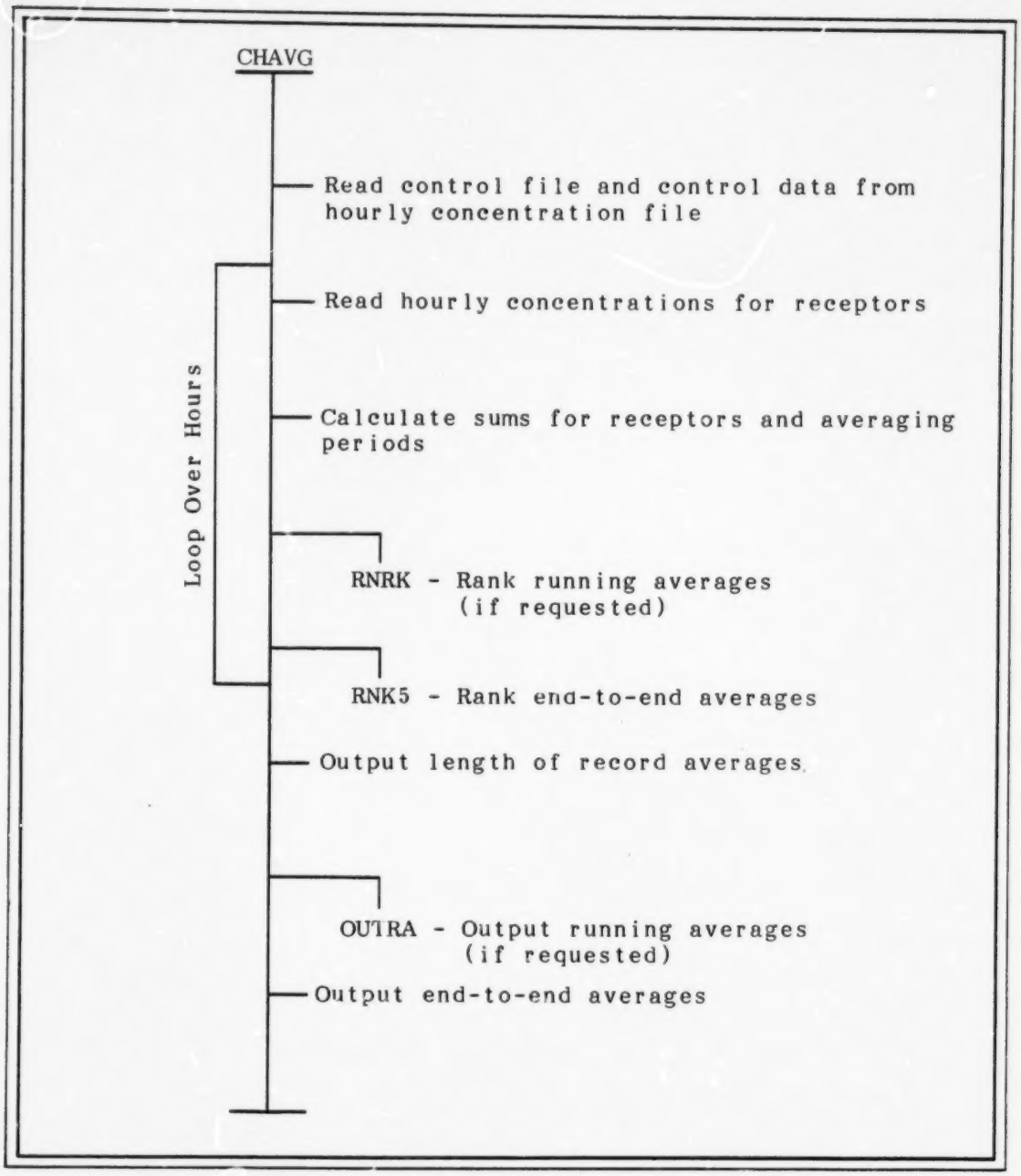

CHAVG
Read control file and control data from hourly concentration file
Read hourly concentrations for receptors
Loop Over Hours
Calculate sums for receptors and averaging periods
RNRK - Rank running averages (if requested)
RNK5 - Rank end-to-end averages
Output length of record averages
OUTRA - Output running averages (if requested)
Output end-to-end averages

Figure 4. CHAVG program outline.

AVERAGE CONCENTRATIONS FOR LENGTH OF RECORD TOTALING 8784 HOURS. PERIOD ENDS AT DAY 366 AND HOUR 24.
(ASTERISK INDICATES HIGHEST CONCENTRATIONS.)

RECEPTOR	EAST COORDINATE (USER UNITS)	NORTH COORDINATE (USER UNITS)	CONCENTRATION (MICRO-GRAMS PER CUBIC METER)
1	-.580	.690	1.041
2	.000	.000	1.443
3	1.500	.000	2.280
4	.960	-1.140	3.183
5	1.880	-.660	3.831
6	2.440	2.910	12.003 *
7	3.740	.660	9.077
8	.580	.890	.705
9	.690	.580	.626
10	-.890	.160	.781
11	.260	1.480	2.375
12	-1.530	-1.280	4.738
13	3.290	1.900	11.109
14			5.086
15			4.977
16			10.374

****
* Receptor Location *
****

****
* Length of Record *
* Averages for Each *
* Receptor *
****

8-HOUR RUNNING AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR								
1	255.27	(164,13)	255.27	(164,14)	255.27	(164,15)	255.27	(164,16)
	255.27	(164,18)	255.27	(164,19)	255.27	(164,20)	251.83	SH(201,12)
2	513.28	(209,16)	513.28	(209,17)	513.28	(209,18)	513.28	(209,19)
	513.28	(209,15)	513.24	(209,14)	512.27	SH(199,13)	512.27	(199,14)
3	356.23	(219,14)				(219,16)	356.23	(219,17)
	356.23	(219,19)				(219,13)	243.57	SH(136,12)
4	615.28*	(203,18)				(203,16)	615.08	(203,17)
	514.98	(203,13)				(203,12)	378.48	SH(142,17)
5	337.12	(247,14)				(247,16)	337.12	(247,17)
	337.12	(247,19)			SH(162,16)		291.98	(162,14)
6	386.98	(197,18)				(197,16)	370.05	SH(136,16)
	388.58	(197,19)				(264,17)	293.17	(264,18)
7	381.18	(156,18)				(269,18)	329.96	(156,16)
	320.04	(269,16)				(156,19)	293.88	(216,15)
8	194.52	(185,18)	194.52	(185,19)	194.52	(185,20)	194.52	(185,21)
	194.52	(185,16)	194.52	(185,17)	194.50	(185,14)	185.16	SH(207,13)
9	260.38	(185,16)	260.38	(185,17)	260.38	(185,15)	260.38	(185,18)
	260.38	(185,20)	260.38	(185,21)	260.38	(185,14)	130.22	SH(142,13)
10	198.49	(227,12)	198.49	(227,13)	198.49	(227,14)	198.49	(227,15)
	197.81	(227,17)	197.81	(227,18)	197.81	(227,19)	148.37	SH(204,14)
11	415.80	(164,15)	415.80	(164,16)	415.80	(164,17)	415.80	(164,18)
	411.09	(164,14)	411.09	(164,13)	340.82	SH(139,15)	340.82	(139,13)
12	428.52	(193,17)	427.79	(193,16)	397.92	(192,14)	397.92	(192,15)
	381.09	(115,14)	370.22	(115,16)	369.49	(115,17)	356.52	(115,13)
13	471.46	(174,18)	416.00	SH(159,16)	402.72	(174,17)	403.60	(210,16)
	368.51	(210,15)	364.76	(210,14)	353.68	(210,13)	353.64	(210,12)
14	415.58	(180,17)	387.21	SH(181,20)	365.31	(181,13)	365.31	(181,19)
	337.00	(180,18)	335.14	(213,16)	323.83	(213,17)	322.68	(180,18)
15	394.20	(122,14)	394.20	(122,13)	393.85	(122,15)	347.21	SH(169,14)
	348.03	(169,13)	345.49	(122,16)	327.77	(169,16)	320.68	(169,12)
16	248.62	(264,16)	248.62	(264,17)	248.55	(264,18)	231.60	(264,19)
	226.87	(264,20)	223.38	(264,21)	220.00	(260,15)	220.00	(260,16)

****
* The Second *
* Highest Non- *
* Overlapping *
* Average for Each *
* Receptor is *
* Marked by SH *
****

****
* Running *
* Averages *
* for Each *
* Receptor *
* and *
* Averaging *
* Period *
****

FIVE HIGHEST 2-HOUR END-TO-END AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR	1		2		3		4	
1	680.72	(164,15)	671.52	(201,13)	664.86	(125,12)	577.37	(214,15)
2	1368.75*	(209,15)	684.28	(199,12)	681.79	(199,15)	557.84	(193,12)
3	949.95	(219,13)	940.52	(136,12)	382.09	(156,15)	381.73	(156,12)
4	1129.86	(203,12)	779.92*	(197,13)	658.57	(198,15)	598.86	(136,12)
5	898.95	(247,15)	455.[illegible]	(265,12)	438.69	(162,15)	375.05	(155,12)
6	611.22	(265,12)	539.[illegible]	(264,12)	536.58	(137,15)	528.80	(159,12)
7	457.41	(269,[illegible]	432.19	(198,12)	431.22	(222,15)	425.91	(160,12)
8	518.73	(185,15)	518.74	(207,12)	349.88	(143,15)	211.33	(139,12)
9						(198,12)	188.68	(174,13)
10						(213,15)	270.71	(206,15)
11						(209,15)	411.68	(193,12)
12						(281,13)	562.98	(115,12)
13						(174,12)	523.52	(208,15)
14						(213,15)	466.59	(180,18)
15						(220,15)	471.27	(173,15)
16						(264,15)	340.86	(302,13)

****
* Highest and Highest Second *
* Highest Marked by Asterisks *
****

****
* End-to-End *
* Averages *
* for Each *
* Receptor *
* and Period *
****

Figure 5. Tables produced by CHAVG.

highest second highest averages in each table are indicated by an asterisk. In addition, the second highest non-overlapping running average concentration for each receptor is indicated by the abbreviation SH.

The end-to-end average tables include the five highest average concentrations for each period and the Julian day and hour on which each average ended. The highest and highest second highest end-to-end concentrations in each table are indicated by an asterisk.

SECTION 6

EXAMPLE PROBLEM

This section presents an example showing the use of CHAVG in conjunction with RAM output.

RAM is used to calculate hourly SO_2 concentrations at 16 receptors resulting from 4 point sources at a central location. The meteorology supplied to RAM is that of Cincinnatti, Ohio (surface data) and Dayton, Ohio (upper air) for the year 1964.

The output from RAM, shown in Figure 6, includes length of record averages and requested tables of the five highest end-to-end averages at each receptor. These tables are comparable with CHAVG output except, as mentioned earlier, RAM does not compute running averages.

The hourly concentration file produced by RAM is used as input to CHAVG. The output from CHAVG, shown in Figure 7, consists of tables of length of record, running, and end-to-end averages.

Of particular interest is the difference in highest second highest values in the running and end-to-end average tables. Variations in the highest second highest are quite important since it is this value which may be used to judge compliance with the NAAQS. Table 1 gives details of the comparison.

TABLE 1. COMPARISON OF END-TO-END AND RUNNING AVERAGE HIGHEST SECOND HIGHEST SO_2 CONCENTRATION FOR EXAMPLE PROBLEM

End-to-End Average			
Averaging time	Conc. ($\mu g/m^3$)	Receptor	Day, ending hour
3 hours	779.92	4	187, 12
8 hours	512.27	2	199, 16
24 hours	170.76	2	199, 24

(continued)

TABLE 1. (continued)

Running Average			
Averaging time	Conc. ($\mu g/m^3$)	Receptor	Day, ending hour
3 hours	1366.07	2	199, 13
8 hours	512.27	2	199, 13
24 hours	170.89	2	199, 13

```
                                                    OUTPUT FROM RURAL RAM (VERSION 80336)
                                                    AN AQDM IN SECTION 2. GUIDELINE MODELS
                                                    IN UNAMAP (VERSION 4) DEC 80
                                                    SOURCE: UNAMAP FILE ON EPA UNIVAC 1110 RTP. NC.
TEST RUN: ALFREIDA D. RANKINS
RAM CHECK OF MPTER FOR FOR 366 DAYS
MET DATA READ OFF PREPROCESSED MET DATA FILE.

                        GENERAL INPUT INFORMATION

 THIS THE RURAL VERSION(80336) OF RAM FOR THE POLLUTANT S02  FOR 366  24-HOUR PERIODS.
 CONCENTRATION ESTIMATES BEGIN ON HOUR- 1, JULIAN DAY-  1, YEAR-1964.
 UNITS - THERE ARE       1.0000000 USER UNITS(INPUT UNITS) PER SMALLEST AREA SOURCE SQUARE SIDE LENGTH(INTERNAL UNIT)
 CONONE - THERE ARE      1.0000000 KILOMETERS PER USER UNIT
 CONTWO - IT IS CALCULATED THAT THERE ARE        1.0000000 KILOMETERS PER SMALLEST AREA SOURCE SQUARE SIDE LENGTH(INTERNAL UNIT)
 RECEPTOR HEIGHT IS        .0000000 METERS

THIS RUN WILL NOT CONSIDER ANY POLLUTANT LOSS.
HIGH-FIVE SUMMARY CONCENTRATION TABLES WILL BE OUTPUT FOR 4 AVERAGING PERIODS.
AVG TIMES OF 1,3,8, AND 24 HOURS ARE AUTOMATICALLY DISPLAYED.

 OPTION      OPTION LIST                          OPTION SPECIFICATION : 0= IGNORE OPTION
                                                                         1= USE OPTION
                   TECHNICAL OPTIONS
       1     NO STACK DOWNWASH                                    1
       2     NO GRADUAL PLUME RISE                                1
       3     USE BOUYANCY INDUCED DISPERSION                      0
       4     NOT USED THIS VERSION                                4

                   INPUT OPTIONS
       5     WILL YOU INPUT POINT SOURCES?                        1
       6     WILL YOU INPUT AREA SOURCES?                         0
       .                  .                                      .
       .                  .                                      .
       .                  .                                      .

                   OTHER CONTROL AND OUTPUT OPTIONS:
      39     RUN IS PART OF A SEGMENTED RUN                       0
      40     WRITE PARTIAL CONC. TO DISK OR TAPE (UNIT 10).       0
      41     WRITE HOURLY CONC. TO DISK OR TAPE (UNIT 12).        1
      42     WRITE AVG-PERIOD CONC. TO DISK OR TAPE (UNIT 13).    0
      43     PUNCH AVERAGING-PERIOD CONC. ON CARDS (UNIT1).       0
       .                  .                                      .
       .                  .                                      .
       .                  .                                      .
      50     NOT USED THIS VERSION.                               0

                                                    ******************************
                                                    * General Input Information *
                                                    ******************************
```

Figure 6. RAM output for example problem.

ANEMOMETER HEIGHT= 7.00
WIND PROFILE WITH HEIGHT EXPONENTS CORRESPONDING TO STABILITY ARE AS FOLLOWS:
FOR STABILITY A: .10 B: .15 C: .20 D: .25 E: .30 F: .30

POINT SOURCE INFORMATION

SOURCE	EAST COORD (USER UNITS)	NORTH COORD (USER UNITS)	SO2(G/SEC) EMISSIONS	PART(G/SEC) EMISSIONS	STACK HT(M)	STACK TEMP(K)	STACK DIAM(M)	STACK VEL(M/SEC)	POTEN. IMPACT (MICRO G/M**3)	EFF HT(M)	BUOY FLUX F M**4/S**3
1 STACK #1	.000	.000	36.220	.000	83.20	428.00	3.05	19.42	20.975	333.124	139.693
2 STACK #2	.000	.000	1395.200	.000	70.70	462.00	3.96	28.19	339.938	536.007	396.431
3 STACK #3	.000	.000	1086.100	.000	114.30	415.00	3.35	28.77	359.829	453.745	232.690
4 STACK #4	.000	.000	3434.800	.000	243.80	405.00	5.91	33.83	296.858	956.502	801.082

SIGNIFICANT SO2 POINT SOURCES

RANK	CHI-MAX (MICROGRAMS/M**3)	SOURCE NO.
1	359.83	3
2	339.94	2
3	296.86	4
4	20.97	1

****
* Source Information *
****

Figure 6. (continued)

ADDITIONAL INFORMATION ON SOURCES.
POINT SOURCE INFORMATION

EMISSION INFORMATION FOR 4 (NPT) POINT SOURCES HAS BEEN INPUT
0 SIGNIFICANT POINT SOURCES (NSIGP) ARE TO BE USED FOR THIS RUN

****
* Meteorology Information *
****

SURFACE MET DATA FROM STATION(ISFCD) 93814, YEAR(ISFCYR) 1964
MIXING HEIGHT DATA FROM STATION(IMXD) 93815, YEAR(IMXYR) 1964

RECEPTOR INFORMATION

RECEPTOR	IDENTIFICATION	EAST COORD (USER UNITS)	NORTH COORD
1	32	-.580	.690
2	36	.000	.900
3	45	1.500	.000
4	50	.960	-1.140
5	83	1.880	-.680
6	112	2.440	2.910
7	116	3.740	.660
8	4	.580	.690
9	5	.690	.580
10	28	-.890	.160
11	37	.260	1.480
12	95	-1.530	-1.290
13	114	3.290	1.900
14	138	-3.290	1.900
15	139	-2.910	2.440
16	149	4.740	3.980

****
* Receptor Information *
****

Figure 6. (continued)

TEST RUN: ALFREIDA D. RANKINS
RAM CHECK OF MPTER FOR 366 DAYS
MET DATA READ OFF PREPROCESSED MET DATA FILE.

RECEPTORS

RECEPTOR	IDENTIFICATION	EAST COORD (USER UNITS)	NORTH COORD (USER UNITS)
1 1 0	32	-.58	.69
2 1 0	36	.00	.90
.	.	.	.
.	.	.	.
.	.	.	.
6 1 0	112	2.44	2.91
7 1 0	116	3.74	.66
.	.	.	.
.	.	.	.
.	.	.	.
13 1 0	114	3.29	1.90
14 1 0	138	-3.29	1.90
15 1 0	139	-2.91	2.44
16 1 0	149	4.74	3.98

DAY	AVG CONC FOR PERIOD 1.HR 1 TO DAY366.HR24. (MICROGRAMS/M**3)
	1.04
	1.44
	.
	.
	.
	12.00
	9.08
	.
	.
	.
	11.19
	5.09
	4.98
	10.37

****
* Length of Record Averages *
* For Each Receptor *
****

FIVE HIGHEST 1-HOUR SO2 CONCENTRATIONS (ENDING ON JULIAN DAY, HOUR)
(MICROGRAMS/M**3)

RECEPTOR			1		2		3		4		5	
1(	-.58,	.69)	2042.15	(164,13)	1994.59	(125,12)	1735.87	(201,12)	1728.40	(214,13)	278.70	(201,10)
2(	.00,	.90)	2071.61	(209,13)	2052.81	(199,11)	2045.37	(199,13)	2034.32	(209,14)	1672.91	(193,11)
3(	1.50,	.00)	2786.99	(219,13)	1948.19	(136,12)	712.40	(156,14)	669.96	(156,12)	636.84	(210,14)
.												
.												
.												
14(	-3.29,	1.90)	982.06	(300,12)	957.86	(202,12)	949.59	(213,15)	938.06	(180,15)	894.69	(254,11)
15(	-2.91,	2.44)	965.50	(169,10)	941.11	(202,10)	927.27	(173,14)	903.70	(229,14)	895.97	(228,11)
16(	4.74,	3.98)	821.98	(199,10)	806.16	(142,13)	767.14	(247,10)	739.66	(210,16)	704.98	(264,16)

****
* Five Highest End-to-end Averages *
* For Each Receptor and Averaging *
* Period *
****

Figure 6. (continued)

FIVE HIGHEST 3-HOUR SO2 CONCENTRATIONS (ENDING ON JULIAN DAY, HOUR)
(MICROGRAMS/M**3)

RECEPTOR			1		2		3		4		5	
1(	-.58,	.69)	680.72	(164,15)	671.52	(201,12)	664.86	(125,12)	577.37	(214,15)	58.85	(174,15)
2(	.00,	.90) •	1368.75	(209,15)	684.26	(199,12)	681.79	(199,15)	557.64	(193,12)	292.26	(139,12)
3(	1.50,	.00)	949.95	(219,15)	649.52	(136,12)	282.09	(156,15)	281.72	(156,12)	225.50	(222,15)
4(	.96,	-1.14)	1129.86	(203,12) •	779.92	(187,12)	658.57	(198,15)	608.86	(136,12)	566.96	(142,12)
.												
.												
.												
14(	-3.29,	1.90)	507.02	(181,15)	474.98	(202,12)	472.58	(213,15)	466.59	(181,18)	428.42	(180,12)
15(	-2.91,	2.44)	592.98	(169,12)	579.37	(275,12)	512.62	(229,15)	471.27	(173,15)	455.70	(122,12)
16(	4.74,	3.98)	436.92	(328,15)	436.58	(260,15)	369.98	(264,15)	340.86	(302,12)	326.99	(314,15)

FIVE HIGHEST 8-HOUR SO2 CONCENTRATIONS (ENDING ON JULIAN DAY, HOUR)
(MICROGRAMS/M**3)

RECEPTOR			1		2		3		4		5	
1(	-.58,	.69)	255.27	(164,16)	251.83	(201,16)	249.49	(125,16)	216.52	(214,16)	31.07	(213,16)
2(	.00,	.90)	513.28	(209,16) •	512.27	(199,16)	209.11	(193,16)	110.06	(139,16)	92.79	(164,16)
3(	1.50,	.00)	356.23	(219,16)	243.57	(136,16)	216.24	(156,16)	91.53	(176,16)	88.84	(131,16)
4(	.96,	-1.14) •	615.08	(203,16)	375.62	(142,16)	360.65	(185,16)	316.47	(187,16)	246.96	(198,16)
.												
.												
.												
14(	-3.29,	1.90)	325.14	(213,16)	322.60	(180,16)	270.95	(181,16)	232.32	(250,16)	218.16	(275,16)
15(	-2.91,	2.44)	345.49	(122,16)	327.77	(169,16)	295.55	(275,16)	220.66	(180,16)	220.60	(250,16)
16(	4.74,	3.98)	248.62	(264,16)	230.77	(159,16)	220.00	(260,16)	214.95	(144,16)	203.67	(302,16)

FIVE HIGHEST 24-HOUR SO2 CONCENTRATIONS (ENDING ON JULIAN DAY, HOUR)
(MICROGRAMS/M**3)

RECEPTOR			1		2		3		4		5	
1(	-.58,	.69)	85.09	(164,24)	83.94	(201,24)	83.16	(125,24)	72.17	(214,24)	10.37	(213,24)
2(	.00,	.90)	171.09	(209,24) •	170.76	(199,24)	69.70	(193,24)	36.69	(139,24)	30.93	(164,24)
3(	1.50,	.00)	118.74	(219,24)	81.19	(1.6,24)	72.10	(156,24)	34.45	(215,24)	30.56	(176,24)
4(	.96,	-1.14) •	205.09	(203,24)	126.15	(142,24)	120.25	(185,24)	105.49	(187,24)	82.32	(198,24)
.												
.												
.												
14(	-3.29,	1.90)	138.59	(180,24)	126.79	(181,24)	125.20	(213,24)	104.01	(250,24)	88.81	(124,24)
15(	-2.91,	2.44)	131.40	(122,24)	115.97	(169,24)	98.52	(275,24)	88.34	(180,24)	86.29	(250,24)
16(	4.74,	3.98)	82.87	(264,24)	81.73	(197,24)	78.48	(108,24)	77.74	(144,24)	76.97	(159,24)

Figure 6. (continued)

CHAVG VERSION 81015

NOTES PERTAINING TO THE REPORT

1. THE HIGHEST LENGTH OF RECORD AVERAGE IS INDICATED BY AN ASTERISK (*).

2. THE HIGHEST AND HIGHEST SECOND RUNNING AVERAGE FOR EACH AVERAGING PERIOD ARE INDICATED BY AN ASTERISK (*).

3. THE SECOND HIGHEST NONOVERLAPPING RUNNING AVERAGE FOR EACH RECEPTOR AND EACH AVERAGING TIME IS INDICATED BY (SH). THE SECOND HIGHEST NONOVERLAPPING RUNNING AVERAGE IS DETERMINED ACCORDING TO METHODS DESCRIBED IN 'GUIDELINES FOR AIR QUALITY MAINTENANCE PLANNING AND ANALYSIS VOLUME II: AIR QUALITY MONITORING AND DATA ANALYSIS' (EPA 450/4-74-012. SEPT. 1974; OAQPS NO. 1.2-030) AND 'GUIDELINES FOR THE INTERPRETATION OF AIR QUALITY STANDARDS' (OAQPS NO. 1.2-008 REV. FEB. 1977).

4. THE HIGHEST AND HIGHEST SECOND END-TO-END AVERAGE FOR EACH AVERAGING PERIOD ARE INDICATED BY AN ASTERISK (*).

****
* Notes Pertaining to the Report *
****

Figure 7. CHAVG output for example problem.

TEST RUN: ALFREIDA D. RANKINS
RAM CHECK OF MPTER FOR 366 DAYS
MET DATA READ OFF PREPROCESSED MET DATA FILE.

CHAVG REPORT
PAGE 1

AVERAGE CONCENTRATIONS FOR LENGTH OF RECORD TOTALING 8784 HOURS. PERIOD ENDS AT DAY 366 AND HOUR 24.
(ASTERISK INDICATES HIGHEST CONCENTRATIONS.)

RECEPTOR	EAST COORDINATE (USER UNITS)	NORTH COORDINATE (USER UNITS)	CONCENTRATION (MICRO-GRAMS PER CUBIC METER)	
1	-.580	.690	1.041	
2	.000	.900	1.443	
6	2.440	2.910	12.003	*
7	3.740	.660	9.077	
13	3.290	1.900	11.189	
14	-3.290	1.900	5.086	
15	-2.910	2.440	4.977	
16	4.740	3.980	10.374	

* The Highest Length of Record Average is Marked by an Asterisk *

* Receptor Locations *

* Length of Record Averages *

TEST RUN: ALFREIDA D. RANKINS
RAM CHECK OF MPTER FOR 366 DAYS
MET DATA READ OFF PREPROCESSED MET DATA FILE.

CHAVG REPORT
PAGE 2

3-HOUR RUNNING AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

* Four Highest 3-hour Running Averages for Each Receptor *

RECEPTOR								
1	680.72	(164,13)	680.72	(164,14)	680.72	(164,15)	671.52 SH	(201,12)
2	1368.75	(209,15)	1368.64*	(209,14)	1366.07 SH	(199,13)	690.54	(209,13)
3	949.95	(219,14)	949.95	(219,15)	929.00	(219,13)	649.52 SH	(136,12)
14	605.00	(180,17)	575.16 SH	(250,13)	549.57	(213,16)	507.02	(181,15)
15	803.04	(169,11)	682.22 SH	(122,13)	592.98	(169,12)	583.77	(169,10)
16	595.69	(264,16)	511.61 SH	(302,13)	436.92	(328,15)	436.58	(260,15)

* Highest Second Highest 3-hour Running Average is 1366.07 $\mu g/m^3$ at Receptor 2 *

Figure 7. (continued)

TEST RUN: ALFREIDA D. RANKINS
RAM CHECK OF MPTER FOR 366 DAYS
MET DATA READ OFF PREPROCESSED MET DATA FILE.

CHAVG REPORT
PAGE 3

8-HOUR RUNNING AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR												
1	255.27	(164,13)	255.27	(164,14)	255.27	(164,15)	255.27	(164,16)	255.27	(164,17)		
	255.27	(164,18)	255.27	(164,19)	255.27	(164,20)	251.83	SH(201,12)				
2	513.28	(209,16)	513.28	(209,17)	513.28	(209,18)	513.28	(209,19)	513.28	(209,20)		
	513.28	(209,15)	513.24	(209,14)	512.27	SH(199,13)	512.27	(199,14)				
3	356.23	(219,14)	356.23	(219,15)	356.23	(219,16)	356.23	(219,17)	356.23	(219,18)		
	356.23	(219,19)	356.23	(219,20)	348.37	(219,13)	243.57	SH(136,12)				
4	615.26*	(203,18)	615.08*	(203,15)	615.08	(203,16)	615.08	(203,17)	609.77	(203,14)		
	514.96	(203,13)	496.48	(203,19)	423.70	(203,12)	378.46	SH(142,17)				
.												
.												
.												
14	415.56	(180,17)	367.21	SH(181,20)	365.31	(181,18)	365.31	(181,19)	358.50	(213,18)		
	337.00	(180,18)	325.14	(213,16)	323.83	(213,17)	322.60	(180,16)				
15	394.20	(122,14)	394.20	(122,13)	393.85	(122,15)	347.21	SH(169,14)	347.21	(169,15)		
	346.02	(169,13)	345.49	(122,16)	327.77	(169,16)	320.60	(169,12)				
16	248.62	(264,16)	248.62	(264,17)	248.55	(264,18)	231.60	(264,19)	230.77	SH(159,16)		
	226.87	(264,20)	223.38	(264,21)	220.00	(260,15)	220.00	(260,16)				

* Nine Highest 8-hour Running Averages for Each Receptor *

* The Second Highest Non-overlapping Average for Each Receptor is Marked by SH *

Figure 7. (continued)

TEST RUN: ALFREIDA D. RANKINS
RAM CHECK OF MPTER FOR 366 DAYS
MET DATA READ OFF PREPROCESSED MET DATA FILE.

CHAVG REPORT
PAGE 4

24-HOUR RUNNING AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR									
1	85.09	(164,13)	85.09	(164,14)	85.09	(164,15)	85.09	(164,16)	85.09 (164,17)
	85.09	(164,18)	85.09	(164,19)	85.09	(164,20)	85.09	(164,21)	85.09 (164,22)
	85.09	(164,23)	85.09	(164,24)	85.09	(165, 1)	85.09	(165, 2)	85.09 (165, 3)
	85.09	(165, 4)	85.09	(165, 5)	85.09	(165, 6)	85.09	(165, 7)	85.09 (165, 8)
	85.09	(165, 9)	85.09	(165,10)	85.09	(165,11)	85.09	(165,12)	83.94 SH(201,12)
2	171.09	(209,16)	171.09	(209,17)	171.09	(209,18)	171.09	(209,19)	171.09 (209,20)
	171.09	(209,21)	171.09	(209,22)	171.09	(209,23)	171.09	(209,24)	171.09 (210, 1)
	171.09	(210, 2)	171.09	(210, 3)	171.09	(210, 4)	171.09	(210, 5)	171.09 (210, 6)
	171.09	(210, 7)	171.09	(210, 8)	171.09	(210, 9)	171.09	(210,10)	171.09 (210,11)
	171.09	(210,12)	171.09	(209,15)	171.08	(209,14)	170.89	SH(199,13)	170.89 (199,14)
3	118.74	(220,11)	118.74	(220,12)					
	118.74	(219,16)	118.74	(219,17)					118.74 (219,15)
	118.74	(219,21)	118.74	(219,22)					118.74 (219,20)
	118.74	(220, 2)	118.74	(220, 3)					118.74 (220, 1)
	118.74	(220, 7)	118.74	(220, 8)					118.74 (220, 6)
									81.20 SH(137,11)
4	205.09*	(204,10)	205.09*	(203,18)					
	205.09	(203,22)	205.09	(203,23)	205.09	(203,24)	205.09	(204, 1)	205.09 (203,21)
	205.09	(204, 3)	205.09	(204, 4)	205.09	(204, 5)	205.09	(204, 6)	205.09 (204, 2)
	205.09	(204, 8)	205.09	(204, 9)	205.03	(203,15)	205.03	(203,16)	205.09 (204, 7)
	204.52	(203,14)	172.91	(203,13)	165.49	(204,11)	142.43	(203,12)	205.03 (203,17)
									126.15 SH(142,17)
.									
.									
.									
15	131.46	(122,15)	131.46	(122,16)	131.46	(122,17)	131.46	(122,18)	131.46 (122,19)
	131.46	(122,20)	131.46	(122,14)	131.46	(122,13)	131.40	(122,21)	131.40 (122,22)
	131.40	(122,23)	131.40	(122,24)	131.40	(123, 1)	131.40	(123, 2)	131.40 (123, 3)
	131.40	(123, 4)	131.40	(123, 5)	131.40	(123, 6)	131.28	(123, 7)	116.08 SH(170, 4)
	116.08	(170, 5)	116.08	(170, 6)	116.08	(170, 7)	116.08	(170, 3)	115.97 (169,24)
16	122.85	(145,14)	108.44	(145,13)	100.91	(145,12)			
	91.94	(265,12)	91.94	(159,13)	90.78	(265,13)			
	88.03	(145, 8)	86.93	(197,17)	86.91	(265,11)			
	82.87	(264,16)	82.87	(264,17)	82.87	(264,18)			
	82.87	(264,21)	82.87	(264,22)	82.87	(264,23)	82.87	(264,24)	82.87 (265, 1)

* In the Running Averages Tables, the Highest and Highest Second Highest (not necessarily non-overlapping) Averages are Marked by Asterisks *

* Twenty-five Highest 24-hour Running Averages for Each Receptor *

Figure 7. (continued)

TEST RUN: ALFREIDA D. RANKINS
RAM CHECK OF MPTER FOR 366 DAYS
MET DATA READ OFF PREPROCESSED MET DATA FILE.

CHAVG REPORT
PAGE 6

FIVE HIGHEST 1-HOUR END-TO-END AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR	1		2		3		4		5	
1	2042.15	(164,13)	1994.59	(125,12)	1735.87	(201,12)	1728.40	(214,13)	273.70	(201,10)
2	2071.61	(209,13)	2052.81*	(199,11)	2045.37	(199,13)	2034.32	(209,14)	1672.91	(193,11)
3	2786.99*	(219,13)	1948.19	(136,12)	712.40	(156,14)	669.96	(156,12)	636.84	(210,14)
.										
.										
.										
14	982.06	(300,12)	957.86	(202,12)	949.59	(213,15)	938.06	(180,15)	894.69	(254,11)
15	965.50	(169,10)	941.11	(202,10)	927.27	(173,14)	903.70	(229,14)	895.97	(228,11)
16	821.98	(199,10)	806.16	(142,13)	767.14	(247,10)	730.66	(210,16)	704.98	(264,16)

* Five Highest 1-hour Averages for Each Receptor *

TEST RUN: ALFREIDA D. RANKINS
RAM CHECK OF MPTER FOR 366 DAYS
MET DATA READ OFF PREPROCESSED MET DATA FILE.

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FIVE HIGHEST 3-HOUR END-TO-END AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR	1		2		3		4		5	
1	680.72	(164,15)	671.52	(201,12)	664.86	(125,12)	577.37	(214,15)	58.85	(174,15)
2	1368.75*	(209,15)	684.28	(199,12)	681.79	(199,15)	557.64	(193,12)	292.26	(139,12)
3	949.95	(219,15)	649.52	(136,12)	282.09	(156,15)	281.72	(156,12)	225.50	(222,15)
4	1129.86	(203,12)	779.92*	(187,12)	658.57	(198,15)	608.86	(136,12)	566.96	(142,12)
.										
.										
.										
14	507.02	(181,15)	474.98	(202,12)	472.58	(213,15)	466.59	(181,18)	428.42	(180,12)
15	592.98	(169,12)	579.37	(275,12)	512.62	(229,15)	471.27	(173,15)	455.70	(122,12)
16	436.92	(328,15)	436.58	(260,15)	369.98	(264,15)	340.86	(302,12)	326.99	(314,15)

* Highest Second Highest 3-hour End-to-end Average is 779.92 $\mu g/m^3$ at Receptor 4 *

* Five Highest 3-hour End-to-end Averages for Each Receptor *

Figure 7. (continued)

TEST RUN: ALFREIDA D. RANKINS
RAM CHECK OF MPTER FOR 366 DAYS
MET DATA READ OFF PREPROCESSED MET DATA FILE.

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FIVE HIGHEST 8-HOUR END-TO-END AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR	1		2		3		4		5	
1	255.27	(164,16)	251.83	(201,16)	249.49	(125,16)	216.52	(214,16)	31.07	(213,16)
2	513.28	(209,16)	512.27*	(199,16)	209.11	(193,16)	110.06	(139,16)	92.79	(164,16)
3	356.23	(219,16)	243.57	(136,16)	216.24	(156,16)	91.53	(176,16)	88.84	(131,16)
4	615.08*	(203,16)	375.62	(142,16)	360.65	(185,16)	316.47	(187,16)	246.96	(198,16)
.										
.										
.										
14	325.14	(213,16)	322.60	(180,16)	270.95	(181,16)	232.32	(250,16)	218.16	(275,16)
15	345.49	(122,16)	327.77	(169,16)	295.55	(275,16)	220.66	(180,16)	220.60	(250,16)
16	248.62	(264,16)	230.77	(159,16)	220.00	(260,16)	214.95	(144,16)	203.67	(302,16)

```
**********************************
* Five Highest 8-hour End-to-end *
* Averages for Each Receptor     *
**********************************
```


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```
**********************************
* Five Highest 24-hour End-to-end *
* Averages for Each Receptor      *
**********************************
```

CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR	1		2		3		4		5	
1	85.09	(164,24)	83.94	(201,24)	83.16	(125,24)	72.17	(214,24)	10.37	(213,24)
2	171.09	(209,24)	170.76*	(199,24)	69.70	(193,24)	36.69	(139,24)	30.93	(164,24)
3	118.74	(219,24)	81.19	(136,24)	72.10	(156,24)	34.45	(215,24)	30.56	(176,24)
4	205.09*	(203,24)	126.15	(142,24)	120.25	(185,24)	105.49	(187,24)	82.32	(198,24)
.										
.										
.										
14	138.59	(180,24)	126.79	(181,24)					88.81	(124,24)
15	131.40	(122,24)	115.97	(169,24)					86.29	(250,24)
16	82.87	(264,24)	81.73	(197,24)	78.48	(108,24)	77.74	(144,24)	76.97	(159,24)

```
**************************************
* In the End-to-end Tables the       *
* Highest and Highest Second         *
* Highest Concentrations are Marked  *
* by Asterisks                       *
**************************************
```

Figure 7. (continued)

SECTION 7

INPUT DATA PREPARATION

CONTROL FILE

The control file required by CHAVG contains an optional fifth averaging period, the averaging statistics to be computed, and the numbers of the selected receptors. The format of this control file, which is read on Unit 5, is shown below.

TABLE 2. RECORD INPUT SEQUENCE FOR CONTROL FILE

Record type	Variable name	Column	Description
1	Filler	1 - 11	FIFTH TIME=
	NAV5	12 - 13	Fifth time (I2). Should be 2, 4, 6, or 12.
2	Filler	1 - 9	AVERAGES=
	MODE	10 - 10	Averaging statistics selector (A1). E for end-to-end and length of record. R for running, end-to-end, and length of record.
3	Filler	1 - 10	RECEPTORS=
	NRSEL	11 - 13	Number of selected receptors (I3). If zero is specified, all receptors in the hourly concentration file are processed, and Record Type 4 may be omitted.
4	NRECP	free format	Selected receptor numbers separated by commas. Record Type 4 may be repeated as needed.

HOURLY CONCENTRATION FILE

The required hourly concentration file may be created by RAM or MPTER, or may correspond to a historical record of air quality data with appropriate header information. The format for this file is given in Table 3.

TABLE 3. RECORD INPUT SEQUENCE FOR HOURLY CONCENTRATION FILE*

Record type	Variable name	Description
1	NPER	Number of averaging periods in the file
(248 bytes unformatted)	NAVG	Number of hours in each averaging period
	HEAD1	First line of title
	HEAD2	Second line of title
	HEAD3	Third line of title
2	NR	Number of receptors (1 to 180)
	RREC	Horizontal coordinate of receptor location for each receptor (user units)
(up to 1444 bytes unformatted)	SREC	Vertical coordinate of receptor location for each receptor (user units)
3	JDAY	Day
	LH	Hour
(up to 728 bytes unformatted)	CHI	Concentration at each receptor (g/m^3)

* Record Type 3 is repeated.

SECTION 8

PROGRAM ACTIVATION AND SAMPLE TEST

CHAVG produces an error-free compile on IBM MVS and Univac EXEC 8 computers with comparable execution results. The program is also operational in mini and microcomputers. A sample job stream is presented below.

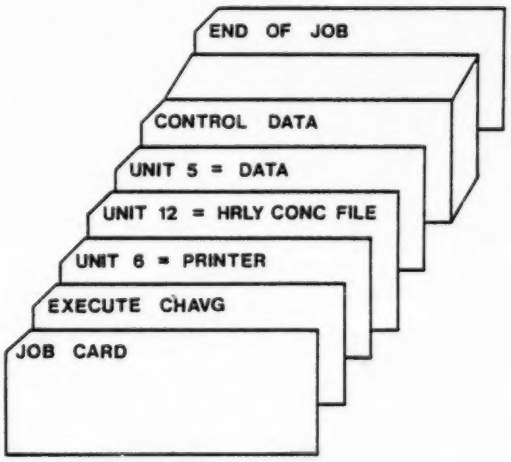

Figure 8. Sample job stream for CHAVG.

The following are sample job control statements for a Univac EXEC 8 system:

```
@RUN,R/R JOB-ID
@ASG,A MODELS*LOAD.
@ASG,A HRLYFILE
@USE 12,HRLYFILE
@XQT MODELS*LOAD.CHAVG
(control data)
@FIN
```

Sample job control language (JCL) for an IBM MVS system is as follows:

```
//JOBID    JOB
//XCHAVG   EXEC PGM=CHAVG
//STEPLIB  DD   DSN=USER.MODELS.LOAD,DISP=SHR
//FT06F001 DD   SYSOUT=A
//FT12F001 DD   DSN=USER.HRLYCONC,DISP=SHR
//FT05F001 DD   *
(control data)
/*
//
```

Sample JCL for a CDC Scope 3.14 system might have the following form:

```
XX,T10,P4.
USER,HALE,EPA.
PROJECT,*PRJ,*XX.
ATTACH,LIB,MODELSLIB,ID=XX.
ATTACH,TAPE12,HRLYCONC,ID=XX.
LIBRARY,LIB.
CHAVG.
*
(control data)
*
```

In order to test CHAVG, an auxiliary program, CHGEN, should be used to generate a small concentration file. CHGEN produces a file consisting of artificial concentrations for 10 days at 20 receptors distributed on a radial grid. The concentrations are generated by the program using the equation of an elliptic paraboloid and a set of sinusoidal variations. Although these data are fictitious, they permit immediate verification of CHAVG.

On an IBM MVS system the job control statements for execution of the sample test, including CHGEN, are as follows:

```
//JOBID    JOB
//XCHGEN   EXEC PGM=CHGEN,TIME=(0,02)
//STEPLIB  DD   DSN=USER.MODELS.LOAD,DISP=SHR
//FT06F001 DD   SYSOUT=A
//FT08F001 DD   DSN=USER.CHAVG.DATA,DISP=SHR,DCB=(LRECL=248,
//      BLKSIZE=12900,RECFM=VBS)
//XCHAVG   EXEC PGM=CHAVG,TIME=(0,05)
//STEPLIB  DD   DSN=USER.MODELS.LOAD,DISP=SHR
//FT06F001 DD   SYSOUT=A
//FT12F001 DD   DSN=USER.CHAVG.DATA,DISP=SHR
//FT05F001 DD   *
FIFTH TIME=04
AVERAGES=R
RECEPTORS=0
/*
//
```

The first part of the output that follows is a display of the hourly concentrations produced by the data generation program. On a test mode, note that the output from CHAVG includes 4-hour averages, as specified by the optional fifth averaging time. Most tables are abbreviated for presentation here.

The cost of executing the program on the EPA Univac 1100 for 16 receptors and 4 sources for an entire year is $7. Users should apply to this figure a multiplier, which for most commercial installations will fall between 2 and 4. It should also be noted that the cost of the run is roughly proportional to the number of receptors selected, and that computing both running averages and end-to-end averages is approximately four times more expensive than computing end-to-end averages alone.

```
NPER,NAVG=     240       1
POSTPROCESSOR TEST
GENERATED DATA
05 JAN 91
NRECEP=   20
       0.0        1.0
       0.0        2.0
       0.0        3.0
       1.4        1.4
       2.1        2.1
       1.0        0.0
       2.0        0.0
       3.0        0.0
       1.4       -1.4
       2.1       -2.1
       0.0       -1.0
       0.0       -2.0
       0.0       -3.0
      -1.4       -1.4
      -2.1       -2.1
      -1.0        0.0
      -2.0        0.0
      -3.0        0.0
      -1.4        1.4
      -2.1        2.1
```

****
* The first two pages of this output are from *
* the data generator, CHGEN. The tables below *
* present some of the hourly concentrations at *
* each of the 20 receptors. The third page *
* begins output for the CHAVG Report. *
****

1	1	64.25	68.95	54.29	65.09	61.78	50.21	46.41	38.78	20.00	20.00
		26.73	20.00	20.00	20.00	20.00	46.31	38.61	27.08	61.91	58.75
1	2	85.17	92.04	85.61	90.33	84.63	70.20	69.04	61.50	24.06	20.00
		31.50	20.00	20.00	20.00	20.00	53.40	35.43	20.00	76.18	70.63
1	3	105.04	113.46	106.31	118.59	109.42	96.59	101.00	94.27	49.81	22.08
		41.48	20.00	20.00	20.00	20.00	54.37	20.00	20.00	79.93	67.33
1	4	118.65	125.22	116.99	145.17	133.36	126.58	136.87	128.14	91.53	73.70
		61.12	20.00	20.00	20.00	20.00	48.98	20.00	20.00	63.16	31.14
1	5	120.70	116.13	98.91	163.39	152.11	154.74	169.01	155.40	139.37	128.65
		91.87	58.48	20.00	20.00	20.00	42.62	20.00	20.00	21.59	20.00
1	6	103.36	79.04	35.04	164.24	152.96	175.17	191.66	175.45	180.32	168.35
		128.95	118.21	93.79	20.00	20.00	44.13	20.00	20.00	20.00	20.00
1	7	89.28	21.82	20.00	140.82	119.13	183.80	200.35	136.16	207.46	190.36
		161.50	170.25	156.77	68.58	20.00	58.49	20.00	20.00	20.00	20.00
1	8	69.31	20.00	20.00	97.41	50.95	180.11	192.00	179.09	220.29	201.19
		188.34	204.05	190.56	126.90	95.19	81.94	20.00	20.00	20.00	20.00
1	9	55.91	20.00	20.00	49.91	20.00	167.74	169.73	152.23	220.46	203.25
		200.85	219.70	202.80	166.56	148.19	105.29	48.83	20.00	20.00	20.00
1	10	49.45	20.00	20.00	20.00	20.00	152.51	143.64	118.20	211.39	196.69
		202.11	221.42	202.73	184.89	171.06	120.48	79.58	22.11	20.00	20.00

⋮						⋮					⋮
10	16	39.50 60.39	20.51 62.29	20.00 58.49	54.00 33.67	47.90 20.00	66.10 30.83	70.76 20.00	66.76 20.00	72.76 20.00	67.95 20.00
10	17	38.56 42.63	32.26 40.40	23.12 35.33	49.96 20.00	47.61 20.00	52.23 25.01	55.65 20.00	52.29 20.00	53.30 20.00	50.81 20.00
10	18	33.96 29.96	33.32 25.33	30.94 20.00	39.87 20.00	38.31 20.00	38.67 23.13	40.65 20.00	38.76 20.00	36.54 20.22	35.06 20.00
10	19	27.46 23.11	27.96 20.00	27.33 20.00	29.46 20.00	28.57 20.00	28.06 22.19	28.84 20.00	28.18 20.00	25.41 23.26	24.06 20.84
10	20	22.06 20.52	22.27 20.00	22.09 20.00	22.39 20.00	22.17 20.00	21.86 20.83	21.96 20.00	21.80 20.00	20.72 21.45	20.05 21.15
10	21	20.00 20.00	20.00 20.00	20.00 20.00	20.00 20.00	20.00 20.00	20.00 20.00	20.00 20.00	20.00 20.00	20.00 20.00	20.00 20.00
10	22	22.15 20.33	22.38 20.00	22.15 20.00	22.19 20.00	22.03 20.00	21.47 21.28	21.28 20.90	20.91 20.34	20.00 22.04	20.00 21.89
10	23	28.43 21.26	29.33 20.00	28.43 20.00	28.30 20.00	27.70 20.00	25.38 25.38	24.31 24.31	22.51 22.51	20.00 28.30	20.00 27.70
10	24	38.36 22.73	40.31 20.00	38.36 20.00	38.08 20.00	36.77 20.00	31.72 31.72	29.38 29.38	25.47 25.47	20.00 38.08	20.00 36.77

CHAVG VERSION 81180

NOTES PERTAINING TO THE REPORT

1. THE HIGHEST LENGTH OF RECORD AVERAGE IS INDICATED BY AN ASTERISK (*).

2. THE HIGHEST AND HIGHEST SECOND RUNNING AVERAGE FOR EACH AVERAGING PERIOD ARE INDICATED BY AN ASTERISK (*).

3. THE SECOND HIGHEST NONOVERLAPPING RUNNING AVERAGE FOR EACH RECEPTOR AND EACH AVERAGING TIME IS INDICATED BY (SH). THE SECOND HIGHEST NONOVERLAPPING RUNNING AVERAGE IS DETERMINED ACCORDING TO METHODS DESCRIBED IN 'GUIDELINES FOR AIR QUALITY MAINTENANCE PLANNING AND ANALYSIS VOLUME 11: AIR QUALITY MONITORING AND DATA ANALYSIS' (EPA 450/4-78-012, SEPT. 1974; OAQPS NO. 1.2-030) AND 'GUIDELINES FOR THE INTERPRETATION OF AIR QUALITY STANDARDS' (OAQPS NO. 1.2-008 REV. FEB. 1977).

4. THE HIGHEST AND HIGHEST SECOND END-TO-END AVERAGE FOR EACH AVERAGING PERIOD ARE INDICATED BY AN ASTERISK (*).

POSTPROCESSOR TEST
GENERATED DATA .
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AVERAGE CONCENTRATIONS FOR LENGTH OF RECORD TOTALING 240 HOURS. PERIOD ENDS AT DAY 10 AND HOUR 24.
(ASTERISK INDICATES HIGHEST CONCENTRATIONS.)

RECEPTOR	EAST COORDINATE (USER UNITS)	NORTH COORDINATE (USER UNITS)	CONCENTRATION (MICRO-GRAMS PER CUBIC METER)
1	0.000	1.000	61.564
2	0.000	2.000	46.331
3	0.000	3.000	41.228
4	1.414	1.414	69.521
5	2.121	2.121	59.995
6	1.000	0.000	102.549
7	2.000	0.000	104.591
8	3.000	0.000	93.496
9	1.414	-1.414	110.767 *
10	2.121	-2.121	101.214
11	0.000	-1.000	96.838
12	0.000	-2.000	96.058
13	0.000	-3.000	85.552
14	-1.414	-1.414	67.605
15	-2.121	-2.121	58.962
16	-1.000	0.000	59.050
17	-2.000	0.000	35.146
18	-3.000	0.000	23.385
19	-1.414	1.414	31.560
20	-2.121	2.121	28.703

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3-HOUR RUNNING AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR							
1	144.15 (5, 6)	143.92 SH(4, 6)	143.01 (5, 5)	142.58 (4, 5)
2	147.56 (5, 5)	147.10 SH(4, 5)	142.57 (6, 5)	141.26 (3, 5)
3	133.48 (5, 5)	133.06 SH(4, 5)	129.05 (6, 5)	128.31 (5, 4)
4	197.41 (5, 6)	197.10 SH(4, 6)	194.53 (5, 7)	194.51 (4, 7)
5	182.64 (5, 6)	182.35 SH(4, 6)	175.99 (6, 6)	175.65 (5, 7)
6	223.66 (4, 8)	223.29 SH(5, 8)	219.60 (4, 9)	218.88 (5, 9)
7	242.77 (4, 8)	242.36 SH(5, 8)	233.93 (4, 7)	233.91 (5, 7)
8	224.35 (4, 8)	223.98 SH(5, 8)	216.02 (3, 8)	215.14 (4, 7)
9	269.37* (4,10)	268.86* (4, 9)	268.02 SH(5,10)	267.95 (5, 9)
10	247.89 (4,10)	246.65 SH(5,10)	246.26 (4, 9)	245.43 (5, 9)
11	245.32 (4,11)	243.71 (4,10)	243.68 SH(5,11)	242.48 (5,10)
12	269.09 (4,11)	267.29 SH(5,11)	266.39 (4,10)	265.03 (5,10)
13	246.46 (4,11)	245.73 (4,10)	244.82 SH(5,11)	244.49 (5,10)
14	221.24 (4,12)	219.81 (4,11)	219.42 SH(5,12)	218.35 (5,11)
15	205.48 (4,12)	203.81 SH(5,12)	201.08 (4,11)	199.75 (5,11)
16	145.07 (4,12)	143.94 SH(5,12)	141.34 (4,11)	140.82 (3,12)
17	103.68 (4,12)	102.91 SH(5,12)	100.85 (3,12)	98.68 (6,12)
18	43.26 (4,12)	43.05 (4,13)	43.03 SH(5,12)	42.82 (5,13)
19	89.42 (5, 4)	99.23 (5, 3)	89.03 SH(4, 4)	88.74 (4, 3)
20	79.39 (5, 3)	79.46 SH(4, 3)	77.75 (6, 3)	76.54 (3, 3)

POSTPROCESSOR TEST
GENERATED DATA
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8-HOUR RUNNING AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR					
1	117.29 (5, 8)	117.03 SH(4, 8)	115.62 (5, 9)	115.45 (4, 9)	113.79 (5, 7)
	113.46 (4, 7)	113.40 (6, 8)	112.67 (3, 8)	111.70 (6, 9)	
2	104.16 (5, 6)	103.78 SH(4, 6)	102.27 (5, 7)	101.89 (4, 7)	100.97 (6, 6)
	99.80 (3, 6)	99.14 (6, 7)	98.05 (3, 7)	97.52 (5, 8)	
3	89.33 (5, 6)	88.96 SH(4, 6)	87.42 (5, 5)	87.37 (5, 7)	87.04 (4, 5)
	87.02 (4, 7)	86.78 (6, 6)	85.68 (3, 6)	84.92 (6, 5)	
4	153.11 (5, 8)	152.84 SH(4, 8)	150.35 (5, 9)	150.17 (4, 9)	147.71 (6, 8)
	146.93 (3, 8)	145.10 (5, 7)	144.98 (6, 9)	144.78 (4, 7)	
.			.		.
.			.		.
.			.		.
19	59.86 (5, 5)	59.60 (5, 4)	59.57 SH(4, 5)	59.39 (5, 6)	59.32 (4, 4)
	59.11 (4, 6)	58.84 (6, 5)	58.19 (6, 4)	57.98 (6, 6)	
20	50.42 (5, 4)	50.42 (5, 5)	50.18 SH(4, 4)	50.18 (4, 5)	49.99 (5, 6)
	49.75 (4, 6)	49.36 (6, 4)	49.36 (6, 5)	48.93 (6, 6)	

POSTPROCESSOR TEST
GENERATED DATA
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24-HOUR RUNNING AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR											
1	69.15	(5, 6)	69.15	(5, 5)	69.15	(5, 7)	69.14	(5, 4)	69.14	(5, 3)
	69.13	(5, 9)	69.12	(5, 3)	69.12	(5,10)	69.10	(5,11)	69.10	(5, 2)
	69.09	(5,12)	69.08	(5,13)	69.07	(5, 1)	69.06	(5,14)	69.05	(4,24)
	69.04	(5,15)	69.04	(4,23)	69.03	(4,22)	69.03	(4,20)	69.03	(4,21)
	69.02	(4,19)	69.01	(4,18)	69.01	(5,16)	68.99	(4,17)	68.99	SH(5,17)
2	51.10	(5, 6)	51.10	(5, 5)	51.10	(5, 7)	51.10	(5, 3)	51.10	(5, 9)
	51.10	(5,10)	51.10	(5,11)	51.10	(5,12)	51.10	(5,13)	51.10	(5,14)
	51.10	(5,15)	51.09	(5,16)	51.09	(5, 4)	51.08	(5,17)	51.07	(5, 3)
	51.05	(5,18)	51.04	(5,19)	51.04	(5, 2)	51.04	(5,20)	51.04	(5,21)
	51.03	(5,22)	51.01	(5, 1)	51.01	(5,23)	50.99	(4,24)	50.97	SH(4,23)
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9	127.54*	(5, 5)	127.54*	(5, 6)	127.53	(5, 4)	127.52	(5, 7)	127.51	(5, 3)
	127.51	(5, 2)	127.50	(4,20)	127.50	(4,21)	127.50	(4,22)	127.50	(4,23)
	127.50	(4,24)	127.50	(5, 1)	127.50	(4,19)	127.50	(4,18)	127.49	(5, 8)
	127.47	(4,17)	127.43	(5, 9)	127.41	(4,16)	127.35	(5,10)	127.31	(4,15)
	127.27	(5,11)	127.18	(5,12)	127.16	(4,14)	127.08	(5,13)	126.93	SH(5,14)
10	116.24	(5, 5)	116.24	(5, 6)	116.23	(5, 4)	116.22	(5, 7)	116.22	(5, 3)
	116.21	(4,20)	116.21	(4,21)	116.21	(4,22)	116.21	(4,23)	116.21	(4,24)
	116.21	(5, 1)	116.21	(5, 2)	116.21	(4,19)	116.21	(4,18)	116.19	(5, 8)
	116.18	(4,17)	116.13	(5, 9)	116.13	(4,16)	116.07	(5,10)	116.04	(4,15)
	115.99	(5,11)	115.91	(4,14)	115.90	(5,12)	115.81	(5,13)	115.73	SH(4,13)
11	111.07	(5, 5)	111.07	(5, 6)	111.06	(5, 4)	111.06	(5, 7)	111.05	(5, 3)
	111.05	(5, 2)	111.04	(5, 1)	111.04	(4,24)	111.04	(4,23)	111.04	(4,22)
	111.04	(4,20)	111.04	(4,21)	111.03	(4,19)	111.03	(4,18)	111.02	(5, 8)
	111.01	(4,17)	110.97	(4,16)	110.97	(5, 9)	110.90	(5,10)	110.90	(4,15)
	110.82	(5,11)	110.77	(4,14)	110.73	(5,12)	110.64	(5,13)	110.60	SH(4,13)
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20	30.29	(5, 4)	30.29	(5, 5)	30.29	(5, 6)	30.29	(5, 7)	30.29	(5, 3)
	30.29	(5, 9)	30.29	(5,10)	30.29	(5,11)	30.29	(5,12)	30.29	(5,13)
	30.29	(5,14)	30.29	(5,15)	30.29	(5,16)	30.29	(5,17)	30.29	(5,18)
	30.29	(5,19)	30.29	(5, 3)	30.29	(5,20)	30.29	(5,21)	30.29	(5,22)
	30.28	(5, 2)	30.27	(5,23)	30.26	(5, 1)	30.24	(4,24)	30.23	SH(5,24)

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4-HOUR RUNNING AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR									
1	140.89	(5, 6)	140.56 SH(4, 6)	136.06	(6, 6)	135.16	(5, 7)	135.13	(3, 6)
2	139.35	(5, 5)	138.93 SH(4, 5)	134.77	(6, 5)	134.59	(5, 5)	134.24	(4, 6)
3	126.68	(5, 5)	126.20 SH(4, 5)	122.59	(6, 5)	121.25	(3, 5)	115.88	(5, 4)
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8	216.84	(4, 8)	216.64 SH(5, 8)	215.03	(4, 9)	214.52	(5, 9)	208.56	(3, 8)
9	266.80*	(4,10)	265.68*SH(5,10)	262.69	(4,11)	261.17	(5,11)	258.00	(4, 9)
10	245.24	(4,10)	244.21 SH(5,10)	242.50	(4,11)	241.10	(5,11)	237.22	(4, 9)
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20	72.77	(5, 3)	72.36 SH(4, 3)	70.91	(6, 3)	69.76	(3, 3)	68.53	(5, 4)

POSTPROCESSOR TEST
GENERATED DATA
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FIVE HIGHEST 1-HOUR END-TO-END AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR	1		2		3		4		5	
1	149.88	(5, 5)	149.64	(4, 5)	148.06	(5, 4)	147.60	(4, 4)	144.58	(6, 5)
2	156.59	(5, 4)	156.09	(4, 4)	151.25	(6, 4)	149.84	(3, 4)	143.99	(5, 5)
3	145.90	(5, 4)	145.44	(4, 4)	140.98	(6, 4)	139.68	(3, 4)	132.76	(5, 3)
4	204.93	(5, 5)	204.83	(5, 6)	204.83	(4, 6)	204.59	(4, 5)	197.38	(6, 5)
5	190.39	(5, 5)	190.37	(5, 6)	190.37	(4, 6)	190.08	(4, 5)	183.44	(6, 5)
6	228.90	(4, 7)	228.52	(5, 7)	223.24	(4, 8)	222.50	(5, 8)	220.38	(3, 7)
7	250.01	(4, 7)	249.59	(5, 7)	240.63	(3, 7)	239.96	(5, 6)	239.96	(4, 6)
8	231.92	(4, 7)	231.53	(5, 7)	223.27	(3, 7)	222.18	(6, 7)	221.94	(4, 8)
9	274.24*	(4, 8)	273.31*	(5, 8)	273.25	(4, 9)	271.87	(5, 9)	264.30	(3, 8)
10	251.50	(4, 9)	250.24	(5, 9)	250.00	(4, 8)	249.17	(5, 8)	242.85	(3, 9)
11	248.96	(4,10)	248.48	(4, 9)	247.30	(5,10)	247.23	(5, 9)	240.80	(3,10)
12	273.25	(4,10)	272.29	(4, 9)	271.41	(5,10)	270.92	(5, 9)	264.22	(3,10)
13	250.94	(4, 9)	249.75	(4,10)	249.68	(5, 9)	248.08	(5,10)	242.31	(3, 9)
14	227.32	(4,10)	226.97	(4,11)	225.81	(5,10)	225.09	(5,11)	219.95	(3,11)
15	211.37	(4,11)	209.93	(4,10)	209.63	(5,11)	208.55	(5,10)	204.88	(3,11)
16	149.94	(4,11)	148.76	(5,11)	146.33	(4,10)	145.53	(3,11)	145.41	(5,10)
17	111.95	(4,11)	111.12	(5,11)	108.84	(3,11)	106.48	(6,11)	104.16	(4,12)
18	55.04	(4,11)	54.73	(5,11)	53.86	(3,11)	52.96	(6,11)	52.09	(4,12)
19	98.36	(5, 3)	97.93	(4, 3)	95.43	(6, 3)	94.22	(3, 3)	93.87	(5, 2)
20	86.56	(5, 2)	86.08	(4, 2)	84.19	(6, 2)	82.82	(3, 2)	81.84	(5, 3)

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FIVE HIGHEST 3-HOUR END-TO-END AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR	1	2	3	4	5
1	144.15 (5, 6)	143.92 (4, 6)	139.09 (6, 6)	138.43 (3, 6)	129.62 (7, 6)
2	132.08 (5, 6)	131.84 (4, 6)	127.54 (6, 6)	126.86 (3, 6)	119.01 (7, 6)
3	105.88 (5, 3)	105.28 (4, 3)	102.78 (6, 3)	102.32 (5, 6)	102.10 (4, 6)
4	197.41 (5, 6)	197.10 (4, 6)	190.16 (6, 6)	189.29 (3, 6)	176.60 (7, 6)
5	182.64 (5, 6)	182.35 (4, 6)	175.99 (6, 6)	175.19 (3, 6)	163.56 (7, 6)
6	219.60 (4, 9)	218.88 (5, 9)	211.78 (3, 9)	209.77 (6, 9)	196.79 (2, 9)
7	232.50 (4, 9)	231.75 (5, 9)	224.17 (3, 9)	222.05 (6, 9)	208.20 (2, 9)
8	213.64 (4, 9)	212.96 (5, 9)	206.04 (3, 9)	204.13 (6, 9)	191.49 (2, 9)
9	268.86* (4, 9)	267.95* (5, 9)	259.14 (3, 9)	256.56 (6, 9)	242.36 (4,12)
10	246.26 (4, 9)	245.43 (5, 9)	237.43 (3, 9)	235.07 (6, 9)	225.77 (4,12)
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20	79.89 (5, 3)	79.46 (4, 3)	77.75 (6, 3)	76.54 (3, 3)	73.41 (7, 3)

POSTPROCESSOR TEST
GENERATED DATA
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FIVE HIGHEST 8-HOUR END-TO-END AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR	1	2	3	4	5
1	117.29 (5, 8)	117.03 (4, 8)	113.40 (6, 8)	112.67 (3, 8)	106.03 (7, 8)
2	97.52 (5, 8)	97.19 (4, 8)	94.54 (6, 8)	93.60 (3, 8)	88.76 (7, 8)
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11	192.14 (4,16)	190.34 (5,16)	186.55 (3,16)	181.44 (6,16)	174.51 (2,16)
12	209.62* (4,16)	207.63* (5,16)	203.45 (3,16)	197.83 (6,16)	190.19 (2,16)
13	192.62 (4,16)	190.81 (5,16)	187.00 (3,16)	181.88 (6,16)	174.93 (2,16)
14	164.76 (4,16)	163.30 (5,16)	160.00 (3,16)	155.86 (6,16)	149.84 (2,16)
15	146.81 (4,16)	145.55 (5,16)	142.61 (3,16)	139.06 (6,16)	133.68 (2,16)
16	108.40 (4,16)	107.50 (5,16)	105.50 (3,16)	102.95 (6,16)	99.29 (2,16)
17	64.93 (4,16)	64.50 (5,16)	63.43 (3,16)	62.20 (6,16)	60.26 (2,16)
18	28.97 (4,16)	28.89 (5,16)	28.68 (3,16)	28.43 (6,16)	28.05 (2,16)
19	53.22 (5, 8)	53.01 (4, 8)	52.01 (6, 8)	51.41 (3, 8)	49.58 (7, 8)
20	44.27 (5, 8)	44.10 (4, 8)	43.39 (6, 8)	42.92 (3, 8)	41.63 (7, 8)

POSTPROCESSOR TEST
GENERATED DATA
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FIVE HIGHEST 24-HOUR END-TO-END AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR	1		2		3		4		5	
1	69.05	(4,24)	68.87	(5,24)	67.14	(3,24)	66.63	(6,24)	63.49	(2,24)
2	50.98	(4,24)	50.96	(5,24)	49.70	(3,24)	49.62	(6,24)	47.32	(2,24)
3	44.97	(4,24)	44.96	(5,24)	43.92	(3,24)	43.89	(6,24)	42.00	(2,24)
4	78.41	(4,24)	78.23	(5,24)	76.11	(3,24)	75.60	(6,24)	71.71	(2,24)
5	67.14	(4,24)	67.03	(5,24)	65.25	(3,24)	64.93	(6,24)	61.69	(2,24)
6	117.65	(4,24)	117.07	(5,24)	114.05	(3,24)	112.41	(6,24)	106.91	(2,24)
7	120.05	(4,24)	119.47	(5,24)	116.34	(3,24)	114.72	(6,24)	109.00	(2,24)
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8	106.91	(4,24)	106.43	(5,24)	103.67	(3,24)	102.32	(6,24)	97.28	(2,24)
9	127.50*	(4,24)	126.74*	(5,24)	123.67	(3,24)	121.49	(6,24)	115.89	(2,24)
10	116.21	(4,24)	115.50	(5,24)	112.81	(3,24)	110.79	(6,24)	105.86	(2,24)
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20	30.24	(4,24)	30.23	(5,24)	29.82	(3,24)	29.78	(6,24)	29.04	(2,24)

POSTPROCESSOR TEST
GENERATED DATA
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FIVE HIGHEST 4-HOUR END-TO-END AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)

RECEPTOR	1		2		3		4		5	
1	118.78	(4, 8)	118.74	(5, 8)	115.85	(5, 4)	115.29	(4, 4)	114.61	(3, 8)
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11	238.99	(4,12)	237.22	(5,12)	231.35	(3,12)	226.35	(6,12)	215.63	(2,12)
12	262.13*	(4,12)	260.18*	(5,12)	253.69	(3,12)	248.16	(6,12)	236.31	(2,12)
13	239.89	(4,12)	238.12	(5,12)	232.22	(3,12)	227.21	(6,12)	216.44	(2,12)
14	217.22	(4,12)	215.60	(5,12)	210.36	(3,12)	205.80	(6,12)	196.22	(2,12)
15	199.60	(4,12)	198.13	(5,12)	193.37	(3,12)	189.19	(6,12)	180.50	(2,12)
16	140.74	(4,12)	139.74	(5,12)	136.55	(3,12)	133.73	(6,12)	127.90	(2,12)
17	90.60	(4,12)	89.98	(5,12)	88.18	(3,12)	86.44	(6,12)	83.15	(2,12)
18	37.44	(4,12)	37.27	(5,12)	36.86	(3,12)	36.38	(6,12)	35.64	(2,12)
19	85.93	(5, 4)	85.51	(4, 4)	83.52	(6, 4)	82.34	(3, 4)	78.70	(7, 4)
20	68.53	(5, 4)	68.20	(4, 4)	66.79	(6, 4)	65.84	(3, 4)	63.26	(7, 4)

REFERENCES

Bowers, J. F., J. R. Bjorklund, and C. S. Cheney. 1979. Industrial Source Complex (ISC) Dispersion Model User's Guide Volume I. EPA-450/4-79-030, U. S. Environmental Protection Agency, Research Triangle Park, NC. 360 pp.

GCA Corporation. 1974. Guildelines for Air Quality Maintenance Planning and Analysis Volume 11: Air Quality Monitoring and Data Analysis. EPA-450/4-74-012 (OAQPS No. 1.2-030), U. S. Environmental Protection Agency, Research Triangle Park, NC. 113 pp.

Pierce, T. E., and D. B. Turner. 1980. User's Guide for MPTER: A Multiple Point Gaussian Dispersion Algorithm With Optional Terrain Adjustment. EPA-600/8-80-016, U. S. Environmental Protection Agency, Research Triangle Park, NC. 247 pp.

Turner, D. B., and J. H. Novak. 1978. User's Guide for RAM Volume I. Algorithm Description and Use. EPA-600/8-78-016a, U. S. Environmental Protection Agency, Research Triangle Park, NC. 70 pp.

Turner, D. B., and J. H. Novak. 1978. User's Guide for RAM Volume II. Data Preparation and Listings. EPA-600/8-78-016b, U. S. Environmental Protection Agency, Research Triangle Park, NC. 232 pp.

U. S. Environmental Protection Agency. 1971. User's Manual - SAROAD (Storage And Retrieval of Aerometric Data). OAQPS No. APTD-0663, Office of Technical Information and Publications, Research Triangle Park, NC. 60 pp.

U. S. Environmental Protection Agency. 1977. Guidelines for the Interpretation of Air Quality Standards. OAQPS No. 1.2-008 (Rev. Feb. 1977), Office of Air Quality Planning and Standards, Research Triangle Park, NC. 19 pp.

U. S. Environmental Protection Agency. 1977. User's Manual for Single Source (CRSTER) Model. EPA-450/2-77-013, Monitoring and Data Analysis Division, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

APPENDIX

FORTRAN SOURCE STATEMENTS

CHAVG

The source code listing of CHAVG is presented in subsequent pages. The program consists of a main module and three subroutines.

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C         CHAVG - VERSION 81180                                              CHA00010
C                                                                            CHA00020
C        ABSTRACT:                                                           CHA00030
C             CHAVG IS A PERIPHERAL PROGRAM DESIGNED TO READ HOURLY          CHA00040
C        CONCENTRATIONS FROM A DISK/TAPE FILE AND DETERMINE LENGTH           CHA00050
C        OF RECORD AVERAGES, RUNNING AVERAGES, AND END-TO-END AVERAGES       CHA00060
C        FOR FOUR OR FIVE AVERAGING PERIODS.  THE USER SELECTS THE           CHA00070
C        OPTIONAL FIFTH AVERAGING PERIOD.  AVERAGES ARE RANKED, AND          CHA00080
C        A NUMBER OF THE HIGHEST AVERAGES ARE OUTPUT FOR EACH RECEPTOR.      CHA00090
C*****  RAMF USERS NOTE THE FOLLOWING  ***********************************CHA00100
C    RECORD ONE IN RAMF'S OUTPUT CONCENTRATION FILE DIFFERS                  CHA00110
C    SLIGHTLY FROM THE READ REQUIREMENT IN CHAVG.                            CHA00120
C    CONSEQUENTLY, IT IS NECESSARY TO MAKE A MINOR CHANGE                    CHA00130
C    TO THE RAMF CODE.  THE VARIABLE NDAYS ON SEQUENCE LINE                  CHA00140
C    RMF3280 SHOULD BE REPLACED BY THE VARIABLES NPER,NAVG                   CHA00150
C*************************************************************************CHA00160
C                                                                            CHA00170
C        AUTHORS: D. B. TURNER, AND T. E. PIERCE                             CHA00180
C                  (ON ASSIGNMENT FROM NOAA TO EPA)                          CHA00190
C                 ENVIRONMENTAL PROTECTION AGENCY  MD-80                     CHA00200
C                 METEOROLOGY AND ASSESSMENT DIVISION                        CHA00210
C                 ENVIRONMENTAL OPERATIONS BRANCH                            CHA00220
C                 RESEARCH TRIANGLE PARK, NC     27711                       CHA00230
C                 J. A. CATALANO, AND F. V. HALE                             CHA00240
C                 AEROCOMP, INC.                                             CHA00250
C                 3303 HARBOR BLVD., SUITE F-4                               CHA00260
C                 COSTA MESA, CA  92626                                      CHA00270
C                                                                            CHA00280
C        PHONE: (919) 541-4564    FTS 629-4564                               CHA00290
C                                                                            CHA00300
C        INPUT DATA:                                                         CHA00310
C         TAPE/DISK FILE OF HRLY CONCENTRATIONS (UNIT NO. 12)                CHA00320
C         CARD INPUT (UNIT NO. 5)                                            CHA00330
C         CARD ONE -- FIFTH AVERAGING TIME                                   CHA00340
C            FIFTH TIME=XX      (I2)                                        CHA00350
C               (SHOULD BE 2, 4, 6, 12, OR LEFT BLANK)                       CHA00360
C         CARD TWO -- SELECTED AVERAGING TYPE                                CHA00370
C            AVERAGES=E(END-TO-END AND LENGTH OF RECORD)   (A1)              CHA00380
C                     R(RUNNING, END-TO-END, AND LENGTH OF RECORD) (A1)      CHA00390
C         CARD THREE -- NUMBER OF RECEPTORS                                  CHA00400
C            RECEPTORS=XXX        (I3)                                       CHA00410
C            LEAVE BLANK TO PROCESS ALL RECEPTORS                            CHA00420
C         CARDS FOUR TO N -- SELECTED RECEPTOR NUMBERS                       CHA00430
C            X,XX,XX,XX,XX,XXX    (FREE FORMAT)                             CHA00440
C            OMIT IF PROCESSING ALL RECEPTORS                                CHA00450
C                                                                            CHA00460
C        PROGRAM OUPUT:                                                      CHA00470
C         LENGTH OF RECORD AVERAGES FOR EACH RECEPTOR.                       CHA00480
C         THE N+1 HIGHEST RUNNING AVERAGES FOR EACH RECEPTOR AND             CHA00490
C            EACH AVERAGING TIME OF N HOURS.  THE SECOND HIGHEST             CHA00500
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C            NONOVERLAPPING RUNNING AVERAGE IS INDICATED FOR EACH       CHA00510
C            RECEPTOR AND AVERAGING TIME.  THE DEFINITION OF THE SECOND CHA00520
C            HIGHEST NONOVERLAPPING RUNNING AVERAGE IS DERIVED FROM     CHA00530
C            'GUIDELINES FOR AIR QUALITY MAINTENANCE PLANNING AND       CHA00540
C            ANALYSIS VOLUME 11: AIR QUALITY MONITORING AND DATA        CHA00550
C            ANALYSIS' (EPA 450/4-74-012, SEPT. 1974; OAQPS NO.         CHA00560
C            1.2-030) P. 78-81 AND 'GUIDELINES FOR THE INTERPRETATION   CHA00570
C            OF AIR QUALITY STANDARDS' (OAQPS NO. 1.2-008, REV. FEB.    CHA00580
C            1977) ISSUE 7B.                                            CHA00590
C            NOTE THAT ONE HOUR RUNNING AVERAGES ARE NOT COMPUTED.      CHA00600
C            THIS IS BECAUSE 1) IT IS NOT POSSIBLE FOR THEM TO OVERLAP, CHA00610
C            AND 2) THEY ARE A SUBSET OF THE END-TO-END AVERAGES.       CHA00620
C          FIVE HIGHEST END-TO-END AVERAGES FOR EACH RECEPTOR AND       CHA00630
C            AVERAGING TIME.                                            CHA00640
C                                                                       CHA00650
C***   MODIFICATION NECESSARY FOR A CHANGE IN THE NUMBER OF RECEPTORS   CHA00660
C***   WHICH CAN BE SELECTED.                                           CHA00670
C***   (BE SURE THAT COMMON IS CHANGED IN ALL ROUTINES.  MORE CHANGES   CHA00680
C***    DESCRIBED IN BLOCK DATA.)                                       CHA00690
C***                                                                    CHA00700
C***   XXX = NUMBER OF RECEPTORS SELECTED                               CHA00710
C***                                                                    CHA00720
C***    COMMON HMAXA(5,XXX,5),CUM(XXX,5),STAR(2,XXX), . . .             CHA00730
C***   1       . . .  IHR(5,XXX,5),NRECP(XXX), . . .                    CHA00740
C***    DIMENSION CNHR(XXX,24),RNMX3(4,XXX),RNMX8(9,XXX),RNMX24(25,XXX), CHA00750
C***   1          RNMXX(13,XXX), . . .                  . . .,SUM(XXX), CHA00760
C***   2          JHR3(4,XXX),JHR8(9,XXX),JHR24(25,XXX),JHRX(13,XXX), ...CHA00770
C***                                                                    CHA00780
C***    2XX =  2 TIMES THE NUMBER OF RECEPTORS SELECTED                 CHA00790
C***    4XX =  4 TIMES THE NUMBER OF RECEPTORS SELECTED                 CHA00800
C***    9XX =  9 TIMES THE NUMBER OF RECEPTORS SELECTED                 CHA00810
C***    13X = 13 TIMES THE NUMBER OF RECEPTORS SELECTED                 CHA00820
C***    24X = 24 TIMES THE NUMBER OF RECEPTORS SELECTED                 CHA00830
C***    25X = 25 TIMES THE NUMBER OF RECEPTORS SELECTED                 CHA00840
C***                                                                    CHA00850
C***    DATA CNHR/24X*0./,RNMX3/4XX*0./,RNMX8/9XX*0./,RNMX24/25X*0./,   CHA00860
C***   1     RNMXX/13X*0./,JHR3/4XX*0/,JHR8/9XX*0/,JHR24/25X*0/,        CHA00870
C***   2     JHRX/13X*0/,SUM/XXX*0./,MAXRCP/XXX/, . . .                 CHA00880
C                                                                       CHA00890
      COMMON /ALL/ HMAXA(5,20,5),CUM(20,5),STAR(2,20),HEAD1(20),        CHA00900
     1             HEAD2(20),HEAD3(20),BLNK,STR,IHR(5,20,5),NRECP(20),  CHA00910
     2             NDAY(25),NHRS(25),NRSEL,NAV5,JDAY,LH,NHR,IPAG,IO     CHA00920
      DIMENSION CNHR(20,24),RNMX3(4,20),RNMX8(9,20),RNMX24(25,20),      CHA00930
     1          RNMXX(13,20),CHI(180),RREC(180),SREC(180),SUM(20),      CHA00940
     2          JHR3(4,20),JHR8(9,20),JHR24(25,20),JHRX(13,20),         CHA00950
     3          ATM(5),NATM(5)                                          CHA00960
      DATA CNHR/480*0./,RNMX3/80*0./,RNMX8/180*0./,RNMX24/500*0./,      CHA00970
     1     RNMXX/260*0./,JHR3/80*0/,JHR8/180*0/,JHR24/500*0/,           CHA00980
     2     JHRX/260*0/,SUM/20*0./,MAXRCP/20/,LCHK/0/,IN/5/,             CHA00990
                                                                        CHA01000
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     3      ILIN/0/,NAVT/4/,NH3/0/,NH8/0/,NHX/0/,NATM/1,3,8,24,0/,
     4      ATM/1.,3.,8.,24.,0./,ME/'E'/,MR/'R'/,J3/21/,J8/16/                CHA01010
C                                                                             CHA01020
C* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *  CHA01030
C       READ CARD TYPE ONE - OPTIONAL AVG TIME                               *CHA01040
      READ (IN,810) NAV5                                                     CHA01050
      IF ((NAV5.EQ.2).OR.(NAV5.EQ.4).OR.(NAV5.EQ.6).OR.(NAV5.EQ.12))         CHA01060
     .   GO TO 8                                                             CHA01070
      IF (NAV5.EQ.0) GO TO 10                                                CHA01080
      WRITE(IO,320) NAV5                                                     CHA01090
      STOP                                                                   CHA01100
 8    ATM(5)=NAV5                                                            CHA01110
      NATM(5)=NAV5                                                           CHA01120
      NAVT=5                                                                 CHA01130
      NAV51 = NAV5 + 1                                                       CHA01140
      J5 = 24-NAV5                                                           CHA01150
C                                                                            CHA01160
C       READ CARD TYPE TWO - AVERAGE TYPE SELECTION                          CHA01170
C                                                                            CHA01180
 10   READ(IN,820)MODE                                                       CHA01190
      IF ((MODE.EQ.ME).OR.(MODE.EQ.MR)) GO TO 20                             CHA01200
      WRITE(IO,830)                                                          CHA01210
      STOP                                                                   CHA01220
C                                                                            CHA01230
C       READ CARD TYPES THREE AND FOUR - RECEPTORS                           CHA01240
C                                                                            CHA01250
 20   READ(IN,840)NRSEL                                                      CHA01260
      IF (NRSEL.EQ.0) GO TO 40                                               CHA01270
      READ(IN,*)(NRECP(I),I=1,NRSEL)                                         CHA01280
C       READ FIRST TWO RECORDS FROM HOURLY FILE.                             CHA01290
C       PROGRAM IS DESIGNED TO HANDLE A MAXIMUM OF 180 RECEPTORS IN          CHA01300
C       THE HOURLY FILE.                                                     CHA01310
 40   READ (12) NPER,NAVG,HEAD1,HEAD2,HEAD3                                  CHA01320
      READ (12) NR,(RREC(I),I=1,NR),(SREC(J),J=1,NR)                         CHA01330
C                                                                            CHA01340
C       CHECK NUMBER OF RECEPTORS IN FILE                                    CHA01350
C                                                                            CHA01360
      IF ((NR.GT.0).AND.(NR.LT.181)) GO TO 50                                CHA01370
         WRITE(IO,850)                                                       CHA01380
         STOP                                                                CHA01390
C                                                                            CHA01400
C       SET FOR PROCESSING ALL RECEPTORS                                     CHA01410
 50   IF (NRSEL.GT.0) GO TO 80                                               CHA01420
         NRSEL = NR                                                          CHA01430
         DO 60 I=1,NR                                                        CHA01440
            NRECP(I) = I                                                     CHA01450
 60      CONTINUE                                                            CHA01460
C                                                                            CHA01470
C       DETERMINE TOTAL NUMBER OF HOURS.                                     CHA01480
C           NPER - NUMBER OF PERIODS                                         CHA01490
                                                                             CHA01500
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C            NAVG - NUMBER OF HOURS WITHIN EACH PERIOD                      CHA01510
C                                                                           CHA01520
80     NT=NPER*NAVG                                                         CHA01530
C         CHECK TO SEE THAT NUMBER OF RECEPTORS IS ACCEPTABLE               CHA01540
       IF (NRSEL.LE.MAXRCP) GO TO 90                                        CHA01550
C         WRITE ERROR MESSAGE.                                              CHA01560
       WRITE (IO,330) NRSEL,MAXRCP                                          CHA01570
       STOP                                                                 CHA01580
90     CONTINUE                                                             CHA01590
C                                                                           CHA01600
C* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *CHA01610
C         INPUT LOOP READS HOURLY DATA AND CALCULATES AVERAGES              CHA01620
C                                                                           CHA01630
       DO 150 IR=1,NT                                                       CHA01640
C                                                                           CHA01650
C         SET HOUR INDEX                                                    CHA01660
C                                                                           CHA01670
       LCHK=LCHK+1                                                          CHA01680
       IF (LCHK.GT.24) LCHK=1                                               CHA01690
C                                                                           CHA01700
C         SET END-TO-END PERIOD INDICES                                     CHA01710
C                                                                           CHA01720
       NH3 = NH3 + 1                                                        CHA01730
       NH8 = NH8 + 1                                                        CHA01740
       IF (NH3.GT.3) NH3 = 1                                                CHA01750
       IF (NH8.GT.8) NH8 = 1                                                CHA01760
C                                                                           CHA01770
C         READ DATA FOR ONE HOUR                                            CHA01780
C                                                                           CHA01790
       READ (12) JDAY,LH,(CHI(I),I=1,NR)                                    CHA01800
C         CHECK TO SEE THAT HOUR MATCHES WHAT IS EXPECTED.                  CHA01810
       IF (LH.EQ.LCHK) GO TO 120                                            CHA01820
C         WRITE ERROR MESSAGE.                                              CHA01830
       WRITE (IO,340) LH,JDAY,LCHK                                          CHA01840
       GO TO 155                                                            CHA01850
120    NHR=NHR+1                                                            CHA01860
C                                                                           CHA01870
C         DETERMINE WHICH AVERAGES ARE TO BE COMPUTED                       CHA01880
C                                                                           CHA01890
       IF (MODE.EQ.ME) GO TO 130                                            CHA01900
C                                                                           CHA01910
C         *****   CALCULATIONS FOR RUNNING AND END-TO-END   *****         CHA01920
C                                                                           CHA01930
       J3 = J3 + 1                                                          CHA01940
       J8 = J8 + 1                                                          CHA01950
       IF (J3.GT.24) J3 = 1                                                 CHA01960
       IF (J8.GT.24) J8 = 1                                                 CHA01970
       IF (NAVT.EQ.4) GO TO 122                                             CHA01980
          J5 = J5 + 1                                                       CHA01990
          IF (J5.GT.24) J5 = 1                                              CHA02000
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122   CONTINUE                                                          CHA02010
C                                                                       CHA02020
C        LOOP OVER RECEPTORS                                            CHA02030
C                                                                       CHA02040
      DO 125 I=1,NRSEL                                                  CHA02050
      A=CHI(NRECP(I))                                                   CHA02060
C        ADD FOR LENGTH-OF-RECORD AVERAGE.                              CHA02070
      SUM(I)=SUM(I)+A                                                   CHA02080
C        ADD CURRENT HOUR TO SUM AND SUBTRACT THE OLDEST HOUR           CHA02090
      CUM(I,1) = A                                                      CHA02100
      CUM(I,2) = (CUM(I,2) + A) - CNHR(I,J3)                            CHA02110
      CUM(I,3) = (CUM(I,3) + A) - CNHR(I,J8)                            CHA02120
      CUM(I,4) = (CUM(I,4) + A) - CNHR(I,LCHK)                          CHA02130
      IF (NAVT.EQ.5) CUM(I,5) = (CUM(I,5) + A) - CNHR(I,J5)             CHA02140
C        SAVE CURRENT CONCENTRATION                                     CHA02150
      CNHR(I,LCHK) = A                                                  CHA02160
C                                                                       CHA02170
125   CONTINUE                                                          CHA02180
C                                                                       CHA02190
C        END LOOP OVER RECEPTORS. NEXT UPDATE TABLES                    CHA02200
C                                                                       CHA02210
      CALL RNRK(RNMX3,JHR3,4,MAXRCP,2)                                  CHA02220
      CALL RNRK(RNMX8,JHR8,9,MAXRCP,3)                                  CHA02230
      CALL RNRK(RNMX24,JHR24,25,MAXRCP,4)                               CHA02240
      CALL RNK5(1)                                                      CHA02250
      IF (NH3.EQ.3) CALL RNK5(2)                                        CHA02260
      IF (NH8.EQ.8) CALL RNK5(3)                                        CHA02270
      IF (LCHK.EQ.24) CALL RNK5(4)                                      CHA02280
      IF (NAVT.EQ.4) GO TO 150                                          CHA02290
         CALL RNRK(RNMCX,JHRX,NAV51,MAXRCP,5)                           CHA02300
         NHX = NHX + 1                                                  CHA02310
         IF (NHX.NE.NAV5) GO TO 150                                     CHA02320
            CALL RNK5(5)                                                CHA02330
            NHX = 0                                                     CHA02340
      GO TO 150                                                         CHA02350
C                                                                       CHA02360
C        *****   CALCULATIONS FOR END-TO-END ONLY   ***                 CHA02370
C                                                                       CHA02380
130   CONTINUE                                                          CHA02390
C                                                                       CHA02400
C        LOOP OVER RECEPTORS                                            CHA02410
C                                                                       CHA02420
      DO 135 I=1,NRSEL                                                  CHA02430
      A=CHI(NRECP(I))                                                   CHA02440
C        ADD FOR LENGTH-OF-RECORD AVERAGE.                              CHA02450
      SUM(I)=SUM(I)+A                                                   CHA02460
C        ADD FOR END-TO-END AVERAGES.                                   CHA02470
      CUM(I,1) = A                                                      CHA02480
      CUM(I,2) = CUM(I,2) + A                                           CHA02490
      CUM(I,3) = CUM(I,3) + A                                           CHA02500
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      CUM(I,4) = CUM(I,4) + A                                          CHA02510
      IF (NAVT.EQ.5) CUM(I,5) = CUM(I,5) + A                           CHA02520
C                                                                      CHA02530
135   CONTINUE                                                         CHA02540
C                                                                      CHA02550
C        END OF LOOP OVER RECEPTORS.  NEXT UPDATE TABLES.              CHA02560
C                                                                      CHA02570
      CALL RNK5(1)                                                     CHA02580
      IF (NH3.NE.3) GO TO 142                                          CHA02590
         CALL RNK5(2)                                                  CHA02600
         DO 141 I=1,NRSEL                                              CHA02610
            CUM(I,2) = 0.                                              CHA02620
141      CONTINUE                                                      CHA02630
142   IF (NH8.NE.8) GO TO 144                                          CHA02640
         CALL RNK5(3)                                                  CHA02650
         DO 143 I=1,NRSEL                                              CHA02660
            CUM(I,3) = 0.                                              CHA02670
143      CONTINUE                                                      CHA02680
144   IF (LCHK.NE.24) GO TO 146                                        CHA02690
         CALL RNK5(4)                                                  CHA02700
         DO 145 I=1,NRSEL                                              CHA02710
            CUM(I,4) = 0.                                              CHA02720
145      CONTINUE                                                      CHA02730
146   IF (NAVT.EQ.4) GO TO 150                                         CHA02740
         NHX = NHX + 1                                                 CHA02750
         IF (NHX.NE.NAV5) GO TO 150                                    CHA02760
            CALL RNK5(5)                                               CHA02770
            NHX = 0                                                    CHA02780
            DO 147 I=1,NRSEL                                           CHA02790
               CUM(I,5) = 0.                                           CHA02800
147         CONTINUE                                                   CHA02810
C                                                                      CHA02820
150   CONTINUE                                                         CHA02830
C        END OF HOURLY LOOP                                            CHA02840
C                                                                      CHA02850
C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * CHA02860
C        OUTPUT TITLE PAGE                                             CHA02870
C                                                                      CHA02880
155   WRITE(IO,400)                                                    CHA02890
      WRITE(IO,410)                                                    CHA02900
      WRITE(IO,420)                                                    CHA02910
      WRITE(IO,430)                                                    CHA02920
      WRITE(IO,440)                                                    CHA02930
      WRITE(IO,450)                                                    CHA02940
C                                                                      CHA02950
C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * CHA02960
C        OUTPUT LENGTH OF RECORD AVERAGES.                             CHA02970
C        DETERMINE AVG CONC FOR LENGTH OF RECORD AND LABEL HIGHEST     CHA02980
C         VALUE WITH AN ASTERISK.                                      CHA02990
      SUM(1)=SUM(1)/NHR                                                CHA03000
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      A=SUM(1)                                                          CHA03010
      MX=1                                                              CHA03020
      IF (NRSEL.EQ.1) GO TO 162                                         CHA03030
      DO 160 K=2,NRSEL                                                  CHA03040
      SUM(K)=SUM(K)/NHR                                                 CHA03050
      IF (SUM(K).LE.A) GO TO 160                                        CHA03060
      MX=K                                                              CHA03070
      A=SUM(K)                                                          CHA03080
160   CONTINUE                                                          CHA03090
162   STAR(1,MX)=STR                                                    CHA03100
C        PRINT AVG CONCS.                                               CHA03110
      DO 170 I=1,NRSEL                                                  CHA03120
      IF (ILIN.GT.0) GO TO 168                                          CHA03130
      IPAG = IPAG + 1                                                   CHA03140
      ILIN = 52                                                         CHA03150
      WRITE (IO,350) HEAD1,HEAD2,IPAG,HEAD3                             CHA03160
      WRITE (IO,360) NT,JDAY,LH                                         CHA03170
      WRITE (IO,365)                                                    CHA03180
168   ILIN = ILIN - 1                                                   CHA03190
170   WRITE (IO,370) NRECP(I),RREC(NRECP(I)),SREC(NRECP(I)),            CHA03200
     .SUM(I),STAR(1,I)                                                  CHA03210
C                                                                       CHA03220
C* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *CHA03230
C        OUTPUT RUNNING AVERAGES                                        CHA03240
C                                                                       CHA03250
C        FIND RECEPTORS WITH HIGHEST AND SECOND HIGHEST CONCENTRATIONS. CHA03260
      IF (MODE.EQ.ME) GO TO 500                                         CHA03270
      STAR(1,MX) = BLNK                                                 CHA03280
      CALL OUTRA(RNMX3,JHR3,4,MAXRCP)                                   CHA03290
      CALL OUTRA(RNMX8,JHR8,9,MAXRCP)                                   CHA03300
      CALL OUTRA(RNMX24,JHR24,25,MAXRCP)                                CHA03310
      IF (NAVT.EQ.5) CALL OUTRA(RNMXX,JHRX,(NAV5+1),MAXRCP)             CHA03320
500   CONTINUE                                                          CHA03330
C* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *CHA03340
C        OUTPUT END-TO-END AVERAGES.                                    CHA03350
C        DIVIDE HI-FIVE CONCS. BY THE APPROPRIATE AVG-TIME              CHA03360
      DO 670 L=2,NAVT                                                   CHA03370
      DX = ATM(L)                                                       CHA03380
      DO 660 K=1,NRSEL                                                  CHA03390
      DO 650 J=1,5                                                      CHA03400
650   HMAXA(J,K,L)=HMAXA(J,K,L)/DX                                      CHA03410
660   CONTINUE                                                          CHA03420
670   CONTINUE                                                          CHA03430
C        WRITE TABLE OF HIGH-FIVE CONCENTRATIONS                        CHA03440
C        FOR EACH AVERAGING TIME.                                       CHA03450
      DO 710 L=1,NAVT                                                   CHA03460
C        FIND RECEPTOR WITH HIGHEST CONCENTRATION AND RECEPTOR WITH     CHA03470
C         SECOND HIGHEST CONC FOR EACH AVERAGING TIME AND LABEL EACH    CHA03480
C         WITH AN ASTERISK.                                            CHA03490
      ILIN = 0                                                          CHA03500
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      K1=1                                                              CHA03510
      K2=1                                                              CHA03520
      A=HMAXA(1,1,L)                                                    CHA03530
      B=HMAXA(2,1,L)                                                    CHA03540
      IF (NRSEL.EQ.1) GO TO 692                                         CHA03550
      DO 690 K=2,NRSEL                                                  CHA03560
      IF (HMAXA(1,K,L).LE.A) GO TO 680                                  CHA03570
      A=HMAXA(1,K,L)                                                    CHA03580
      K1=K                                                              CHA03590
680   IF (HMAXA(2,K,L).LE.B) GO TO 690                                  CHA03600
      B=HMAXA(2,K,L)                                                    CHA03610
      K2=K                                                              CHA03620
690   CONTINUE                                                          CHA03630
692   STAR(1,K1)=STR                                                    CHA03640
      STAR(2,K2)=STR                                                    CHA03650
C        PRINT TABLE OF HIGH-FIVE CONCENTRATIONS FOR THIS AVERAGING TIMECHA03660
      DO 700 K=1,NRSEL                                                  CHA03670
      DO 695 IX=1,5                                                     CHA03680
      IY = IHR(IX,K,L) - 1                                              CHA03690
      NDAY(IX) = IY/24                                                  CHA03700
      NHRS(IX)  = 1 + (IY - 24*NDAY(IX))                                CHA03710
695   CONTINUE                                                          CHA03720
      IF (ILIN.GT.0) GO TO 698                                          CHA03730
      IPAG = IPAG + 1                                                   CHA03740
      ILIN = 52                                                         CHA03750
      WRITE (IO,790) HEAD1,HEAD2,IPAG,HEAD3                             CHA03760
      WRITE (IO,795) NATM(L),(I,I=1,5)                                  CHA03770
698   ILIN = ILIN - 1                                                   CHA03780
      WRITE (IO,800) NRECP(K),(HMAXA(J,K,L),STAR(J,K),NDAY(J),          CHA03790
     1NHRS(J),J=1,2),(HMAXA(J,K,L),NDAY(J),NHRS(J),J=3,5)               CHA03800
700   CONTINUE                                                          CHA03810
      STAR(1,K1)=BLNK                                                   CHA03820
      STAR(2,K2)=BLNK                                                   CHA03830
710   CONTINUE                                                          CHA03840
      STOP                                                              CHA03850
C                                                                       CHA03860
C* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *CHA03870
C                                                                       CHA03880
320   FORMAT (' INVALID FIFTH AVERAGING TIME --',I7)                    CHA03890
330   FORMAT (' THE NUMBER OF INPUT RECEPTORS SELECTED (',I6,           CHA03900
     1') EXCEEDS THE ALLOWABLE NUMBER OF RECEPTORS (',I6,').'/          CHA03910
     2' EXECUTION TERMINATED.')                                         CHA03920
340   FORMAT ('0READ ',I4,' HOUR ON DAY ',I4,'. DID NOT MATCH HOUR',    CHA03930
     1I3,'.  RUN NOT COMPLETED.'/' TABLES ARE FOR PARTIAL RUN')        CHA03940
350   FORMAT (1H1,20A4,30X,'CHAVG REPORT'/1X,20A4,30X,'PAGE',I4/1X,20A4)CHA03950
360   FORMAT ('0AVERAGE CONCENTRATIONS FOR LENGTH OF RECORD TOTALING'   CHA03960
     1,I5,' HOURS.  PERIOD ENDS AT DAY',I4,' AND HOUR',I3,'.'/6X,'(ASTERCHA03970
     2ISK INDICATES HIGHEST CONCENTRATIONS.)')                          CHA03980
365   FORMAT (/6X,'RECEPTOR     EAST COORDINATE',                       CHA03990
     3'     NORTH COORDINATE           CONCENTRATION'/20X,'(USER UNITS)',CHA04000
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     47X,'(USER UNITS)',5X,'(MICRO-GRAMS PER CUBIC METER)')                  CHA04010
                                                                            CHA04020
370   FORMAT (1H ,I10,F15.3,F20.3,3X,6PF25.3,1X,A1)                         CHA04030
400   FORMAT (1H1,12(/),57X,'CHAVG VERSION 81180'//'0',52X,'NOTES ',        CHA04040
     1'PERTAINING TO THE REPORT'//'0',38X,'1.  THE HIGHEST LENGTH ',        CHA04050
     2'OF RECORD AVERAGE IS INDICATED'/43X,'BY AN ASTERISK (*).')           CHA04060
410   FORMAT ('0',38X,'2.  THE HIGHEST AND HIGHEST SECOND RUNNING ',        CHA04070
     1'AVERAGE'/43X,'FOR EACH AVERAGING PERIOD ARE INDICATED BY AN'/        CHA04080
     243X,'ASTERISK (*).')                                                  CHA04090
420   FORMAT ('0',38X,'3.  THE SECOND HIGHEST NONOVERLAPPING RUNNING',      CHA04100
     1' AVERAGE'/43X,'FOR EACH RECEPTOR AND EACH AVERAGING TIME IS'/        CHA04110
     243X,'INDICATED BY (SH).  THE SECOND HIGHEST NONOVER-')                CHA04120
430   FORMAT (43X,'LAPPING RUNNING AVERAGE IS DETERMINED ACCORDING'/         CHA04130
     143X,'TO METHODS DESCRIBED IN ''GUIDELINES FOR AIR'/43X,               CHA04140
     2'QUALITY MAINTENANCE PLANNING AND ANALYSIS VOLUME')                   CHA04150
440   FORMAT (43X,'11: AIR QUALITY MONITORING AND DATA ANALYSIS'''/          CHA04160
     143X,'(EPA 450/4-74-012, SEPT. 1974; OAQPS NO. 1.2-030)'/43X,          CHA04170
     2'AND ''GUIDELINES FOR THE INTERPRETATION OF AIR')                     CHA04180
450   FORMAT (43X,'QUALITY STANDARDS'' (OAQPS NO. 1.2-008 REV. FEB.'/        CHA04190
     143X,'1977).'/'0',38X,'4.  THE HIGHEST AND HIGHEST SECOND END',        CHA04200
     2'-TO-END AVERAGE'/43X,'FOR EACH AVERAGING PERIOD ARE INDICATED',      CHA04210
     3' BY AN'/43X,'ASTERISK (*).')                                         CHA04220
790   FORMAT ('1',20A4,30X,'CHAVG REPORT'/1X,20A4,30X,'PAGE',I4/             CHA04230
     11X,20A4)                                                              CHA04240
795   FORMAT ('0FIVE HIGHEST',I3,'-HOUR END-TO-END AVERAGE CONCEN',          CHA04250
     1'TRATIONS IN MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)'/             CHA04260
     2'0RECEPTOR',6X,4(I1,24X),I1,/1X)                                      CHA04270
800   FORMAT (I5,2(3X,6PF11.2,A1,2X,'(',I3,',',I2,')'),                      CHA04280
     13(3X,6PF11.2,3X,'(',I3,',',I2,')'))                                   CHA04290
810   FORMAT (11X,I2)                                                        CHA04300
820   FORMAT (9X,A1)                                                         CHA04310
830   FORMAT (' INVALID AVERAGES SELECTOR (MUST BE E FOR END-TO-END ',        CHA04320
     .'AVERAGES OR R FOR RUNNING AND END-TO-END)')                          CHA04330
840   FORMAT(10X,I3)                                                         CHA04340
850   FORMAT(' LESS THAN ONE OR MORE THAN 180 RECEPTORS IN HOURLY ',          CHA04350
     .'CONCENTRATION FILE')                                                 CHA04360
      END


      SUBROUTINE RNRK(RNMX,JHX,LIM,NRX,I)                                   CHA04370
C        SUBROUTINE TO RANK RUNNING AVERAGES.                               CHA04380
C        PARAMETERS ARE:                                                    CHA04390
C          RNMX - TABLE OF HIGH AVERAGES FOR EACH RECEPTOR                  CHA04400
C          JHX  - TABLE OF HOURS CORRESPONDING TO ENTRIES IN RNMX           CHA04410
C          LIM  - FIRST DIMENSION OF RNMX AND JHX; 1 + AVERAGING            CHA04420
C                 PERIOD                                                    CHA04430
C          NRX  - SECOND DIMENSION OF RNMX AND JHX; MAXIMUM NUMBER          CHA04440
C                 OF RECEPTORS                                              CHA04450
C          I    - INDEX OF AVERAGING PERIOD FOR CUM                         CHA04460
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C                                                                       CHA04470
      COMMON /ALL/ HMAXA(5,20,5),CUM(20,5),STAR(2,20),HEAD1(20),        CHA04480
     1             HEAD2(20),HEAD3(20),BLNK,STR,IHR(5,20,5),NRECP(20),  CHA04490
     2             NDAY(25),NHRS(25),NRSEL,NAV5,JDAY,LH,NHR,IPAG,IO     CHA04500
      DIMENSION RNMX(LIM,NRX),JHX(LIM,NRX)                              CHA04510
C                                                                       CHA04520
C***  LIM1 IS THE AVERAGING PERIOD; MAKE SURE THAT THE RUNNING AVERAGE  CHA04530
C***  IS COMPLETE.                                                      CHA04540
      LIM1 = LIM-1                                                      CHA04550
      IF (NHR.LT.LIM1) RETURN                                           CHA04560
C***   LOOP OVER ALL RECEPTORS                                          CHA04570
      DO 500 K=1,NRSEL                                                  CHA04580
C        IS CONC. LOWER THAN LEAST?                                     CHA04590
      IF (CUM(K,I).LE.RNMX(LIM,K)) GO TO 500                            CHA04600
      A=CUM(K,I)                                                        CHA04610
      DO 10 J=1,LIM                                                     CHA04620
      IF (A.GT.RNMX(J,K)) GO TO 20                                      CHA04630
C        CONCENTRATION IS ONE OF THE TOP CONC.'S FOR THIS RECEPTOR      CHA04640
10    CONTINUE                                                          CHA04650
C        WRITE ERROR STATEMENT IF TABLE IS INCORRECT                    CHA04660
      WRITE (IO,70)                                                     CHA04670
      GO TO 500                                                         CHA04680
20    IF (J.EQ.LIM) GO TO 40                                            CHA04690
C        J IS BETWEEN 1 AND LIM1.                                       CHA04700
C        CASCADE DATA DOWN ENDING WITH JTH TO J+1ST                     CHA04710
      JL = J+LIM1                                                       CHA04720
      DO 30 JAX=J,LIM1,1                                                CHA04730
      JA = JL-JAX                                                       CHA04740
      JB=JA+1                                                           CHA04750
      RNMX(JB,K)=RNMX(JA,K)                                             CHA04760
      JHX(JB,K)=JHX(JA,K)                                               CHA04770
30    CONTINUE                                                          CHA04780
C        PUT NEW VALUES IN JTH POSITION.                                CHA04790
40    RNMX(J,K)=A                                                       CHA04800
      JHX(J,K)=LH + (24*JDAY)                                           CHA04810
500   CONTINUE                                                          CHA04820
      RETURN                                                            CHA04830
C                                                                       CHA04840
70    FORMAT (' ERROR IN RANKING RUNNING AVERAGES')                     CHA04850
C                                                                       CHA04860
      END                                                               CHA04870



      SUBROUTINE RNK5 (L)                                               CHA04880
C        SUBROUTINE RNK5 IS CALLED BY CHAVG AND IS DESIGNED             CHA04890
C        TO ARRANGE CONCENTRATION ARRAYS SO THAT HIGH-FIVE              CHA04900
C        CONCENTRATION TABLES CAN BE OUTPUT.                            CHA04910
C              OUTPUT VARIABLES:                                        CHA04920
```

```
C                HMAXA(J,K,L) : CONCENTRATION ARRAY FOR                  CHA04930
C                      J - RANK OF THE CONCENTRATION (1 - 5)             CHA04940
C                      K - RECEPTOR NUMBER                               CHA04950
C                      L - AVERAGING TIME                                CHA04960
C                IHR(J,K,L)  : HR OF ENDING CONC                         CHA04970
C                                                                        CHA04980
      COMMON /ALL/ HMAXA(5,20,5),CUM(20,5),STAR(2,20),HEAD1(20),         CHA04990
     1             HEAD2(20),HEAD3(20),BLNK,STR,IHR(5,20,5),NRECP(20),   CHA05000
     2             NDAY(25),NHRS(25),NRSEL,NAV5,JDAY,LH,NHR,IPAG,IO      CHA05010
C                                                                        CHA05020
      DO 50 K=1,NRSEL                                                    CHA05030
      IF (CUM(K,L).LE.HMAXA(5,K,L)) GO TO 50                             CHA05040
      DO 10 J=1,5                                                        CHA05050
      IF (CUM(K,L).GT.HMAXA(J,K,L)) GO TO 20                             CHA05060
C          CONCENTRATION IS ONE OF THE TOP FIVE                          CHA05070
10    CONTINUE                                                           CHA05080
      WRITE (IO,70)                                                      CHA05090
      GO TO 50                                                           CHA05100
C        THE FOLLOWING DO-LOOP HAS THE EFFECT OF INSERTING A NEW         CHA05110
C        CONCENTRATION ENTRY INTO ITS PROPER POSITION WHILE SHIFTING     CHA05120
C        DOWN THE 'OLD' LOWER CONCENTRATIONS THUS ESTABLISHING THE       CHA05130
C        'HIGH-FIVE' CONCENTRATION TABLE.                                CHA05140
20    IF (J.EQ.5) GO TO 40                                               CHA05150
      I4 = J+4                                                           CHA05160
      DO 30 IJX=J,4,1                                                    CHA05170
      IJ = I4-IJX                                                        CHA05180
      IJP1=IJ+1                                                          CHA05190
      HMAXA(IJP1,K,L)=HMAXA(IJ,K,L)                                      CHA05200
30    IHR(IJP1,K,L)=IHR(IJ,K,L)                                          CHA05210
C          INSERT LATEST CONC, DAY AND START HR INTO THE                 CHA05220
C          PROPER RANK IN THE HIGH-FIVE TABLE                            CHA05230
40    HMAXA(J,K,L)=CUM(K,L)                                              CHA05240
      IHR(J,K,L)=LH + (24*JDAY)                                          CHA05250
50    CONTINUE                                                           CHA05260
      RETURN                                                             CHA05270
C                                                                        CHA05280
70    FORMAT (' ERROR IN RANKING END-TO-END AVERAGES')                   CHA05290
C                                                                        CHA05300
      END                                                                CHA05310
```

```
      SUBROUTINE OUTRA (RNMX,JHX,LIM,NRX)                                CHA05320
      COMMON /ALL/ HMAXA(5,20,5),CUM(20,5),STAR(2,20),HEAD1(20),         CHA05330
     1             HEAD2(20),HEAD3(20),BLNK,STR,IHR(5,20,5),NRECP(20),   CHA05340
     2             NDAY(25),NHRS(25),NRSEL,NAV5,JDAY,LH,NHR,IPAG,IO      CHA05350
      DIMENSION RNMX(LIM,NRX),JHX(LIM,NRX),SECHI(25)                     CHA05360
      DATA SECHI/25*'  '/,CTWO/'SH'/                                     CHA05370
      LIM1 = LIM - 1                                                     CHA05380
```

```
      ILIN = 0                                                          CHA05390
      K1=1                                                              CHA05400
      K2=1                                                              CHA05410
      A=RNMX(1,1)                                                       CHA05420
      B=RNMX(2,1)                                                       CHA05430
C        IF NEW CONC. IS HIGHER THAN A, REPLACE A.                      CHA05440
      IF (NRSEL.EQ.1) GO TO 191                                         CHA05450
      DO 190 K=2,NRSEL                                                  CHA05460
      IF (RNMX(1,K).LE.A) GO TO 180                                     CHA05470
      A=RNMX(1,K)                                                       CHA05480
      K1=K                                                              CHA05490
180   IF (RNMX(2,K).LE.B) GO TO 190                                     CHA05500
      B=RNMX(2,K)                                                       CHA05510
      K2=K                                                              CHA05520
190   CONTINUE                                                          CHA05530
191   STAR(1,K1)=STR                                                    CHA05540
      STAR(2,K2)=STR                                                    CHA05550
C                                                                       CHA05560
C***   LOOP OVER ALL RECEPTORS                                          CHA05570
      DO 240 J=1,NRSEL                                                  CHA05580
C***   PREPARE DATE FOR OUTPUT, LOCATE SECOND HIGHEST NONOVERLAPPING    CHA05590
C***   AVERAGE, AND PRINT CONCENTRATIONS                                CHA05600
        ISW = 0                                                         CHA05610
        DO 220 K=1,LIM                                                  CHA05620
        I = JHX(K,J) - 1                                                CHA05630
        NDAY(K) = I/24                                                  CHA05640
        NHRS(K)  = 1 + (I - 24*NDAY(K))                                 CHA05650
        RNMX(K,J) = RNMX(K,J)/LIM1                                      CHA05660
        IF ((ISW.EQ.1).OR.(K.EQ.1)) GO TO 220                           CHA05670
        DO 218 L=1,K                                                    CHA05680
        IF (IABS(JHX(K,J)-JHX(L,J)).LT.LIM1) GO TO 218                  CHA05690
        ISW = 1                                                         CHA05700
        K3 = K                                                          CHA05710
        SECHI(K) = CTWO                                                 CHA05720
218     CONTINUE                                                        CHA05730
220     CONTINUE                                                        CHA05740
      IF (ILIN.GT.0) GO TO 238                                          CHA05750
      IPAG = IPAG + 1                                                   CHA05760
      ILIN = 52                                                         CHA05770
      WRITE (IO,380) HEAD1,HEAD2,IPAG,HEAD3,LIM1                        CHA05780
238   ILIN = ILIN - ((LIM/5) + 1)                                       CHA05790
      WRITE (IO,410) NRECP(J),(RNMX(K,J),STAR(K,J),SECHI(K),NDAY(K),    CHA05800
     1NHRS(K),K=1,2),(RNMX(K,J),SECHI(K),NDAY(K),NHRS(K),K=3,LIM)       CHA05810
      IF (LIM.LE.5) GO TO 240                                           CHA05820
      WRITE(IO,420)                                                     CHA05830
      ILIN = ILIN-1                                                     CHA05840
240   SECHI(K3) = BLNK                                                  CHA05850
      STAR(1,K1)=BLNK                                                   CHA05860
      STAR(2,K2)=BLNK                                                   CHA05870
C        REPLACE ASTERISKS WITH BLANKS.                                 CHA05880
```

```
      RETURN                                                            CHA05890
380   FORMAT ('1',20A4,30X,'CHAVG REPORT'/1X,20A4,30X,'PAGE',I4/        CHA05900
     11X,20A4/'0',I3,'-HOUR RUNNING AVERAGE CONCENTRATIONS IN ',        CHA05910
     2'MICROGRAMS/M**3 (ENDING ON JULIAN DAY, HR)'/'0RECEPTOR')         CHA05920
410   FORMAT (1H ,I4,2(3X,6PF11.2,A1,A2,'(',I3,',',I2,')'),3(3X,        CHA05930
     16PF11.2,1X,A2,'(',I3,',',I2,')'),3(/5X,5(3X,6PF11.2,1X,A2,        CHA05940
     2'(',I3,',',I2,')'))/5X,5(3X,6PF11.2,1X,A2,'(',I3,',',             CHA05950
     3I2,')'))                                                          CHA05960
420   FORMAT(' ')                                                       CHA05970
      END                                                               CHA05980


      BLOCK DATA                                                        CHA05990
C***                                                                    CHA06000
C***   INSTRUCTIONS FOR CHANGING NUMBER OF RECEPTORS                    CHA06010
C***   (ALSO SEE COMMENTS IN MAIN PROGRAM)                              CHA06020
C***                                                                    CHA06030
C***   25X = 25 TIMES NUMBER OF RECEPTORS                               CHA06040
C***   5XX =  5 TIMES NUMBER OF RECEPTORS                               CHA06050
C***   2XX =  2 TIMES NUMBER OF RECEPTORS                               CHA06060
C***                                                                    CHA06070
C***   DATA HMAXA/25X*0./,CUM/5XX*0./,STAR/2XX*' '/, . . .              CHA06080
C***  1      . . . ,IHR/25X*0/, . . .                                   CHA06090
C                                                                       CHA06100
      COMMON /ALL/ HMAXA(5,20,5),CUM(20,5),STAR(2,20),HEAD1(20),        CHA06110
     1             HEAD2(20),HEAD3(20),BLNK,STR,IHR(5,20,5),NRECP(20),CHA06120
     2             NDAY(25),NHRS(25),NRSEL,NAV5,JDAY,LH,NHR,IPAG,IO   CHA06130
      DATA HMAXA/500*0./,CUM/100*0./,STAR/40*' '/,BLNK/'  '/,           CHA06140
     1     STR/'*'/,IHR/500*0/,NHR/0/,IPAG/0/,IO/6/                     CHA06150
      END                                                               CHA06160
```

CHGEN

CHGEN generates an hourly concentration file which may be used to verify CHAVG. The source code listing is given on the following pages.

```
C***  DATA GENERATION FOR POSTPROCESSORS                                  CHG00010
C                                                                         CHG00020
      INTEGER*2 I                                                         CHG00030
      REAL LINE1,LINE2,LINE3                                              CHG00040
      DIMENSION LINE1(20),LINE2(20),LINE3(20)                             CHG00050
      DIMENSION RREC(20),SREC(20),IDATE(2),PHCHI(20)                      CHG00060
      DATA LINE1/'POST','PROC','ESSO','R TE','ST  ',15*'    '/,           CHG00070
     .     LINE2/'GENE','RATE','D DA','TA  ',' ',   ',15*'    '/,       CHG00080
     .     LINE3/'05 J','AN 8','1   ',' ',  ' ',   ',15*'    '/,       CHG00090
     .     RREC/0.,0.,0.,1.414,2.121,1.,2.,3.,1.414,2.121,               CHG00100
     .          0.,0.,0.,-1.414,-2.121,-1.,-2.,-3.,-1.414,-2.121/,       CHG00110
     .     SREC/1.,2.,3.,1.414,2.121,0.,0.,0.,-1.414,-2.121,             CHG00120
     .          -1.,-2.,-3.,-1.414,-2.121,0.,0.,0.,1.414,2.121/          CHG00130
C                                                                         CHG00140
C***  YEAR AND JULIAN DAY                                                 CHG00150
C                                                                         CHG00160
      IDATE(1) = 81                                                       CHG00170
      IDATE(2) =  1                                                       CHG00180
C                                                                         CHG00190
C***  240 ONE HOUR PERIODS (TEN DAYS)                                     CHG00200
C                                                                         CHG00210
      NPER = 240                                                          CHG00220
      NAVG = 1                                                            CHG00230
C                                                                         CHG00240
C***  TWENTY RECEPTORS                                                    CHG00250
C                                                                         CHG00260
      NRECEP = 20                                                         CHG00270
C                                                                         CHG00280
      WRITE(8)NPER,NAVG,LINE1,LINE2,LINE3                                 CHG00290
      WRITE(8)NRECEP,(RREC(J),J=1,NRECEP),(SREC(J),J=1,NRECEP)            CHG00300
C                                                                         CHG00310
      LH = 1                                                              CHG00320
      PI = 3.14159                                                        CHG00330
C                                                                         CHG00340
C***  BASELINE CONCENTRATION                                              CHG00350
C                                                                         CHG00360
      BASE = 20.                                                          CHG00370
      DO 100 L = 1,NPER                                                   CHG00380
C                                                                         CHG00390
C***  DIURNAL VARIATION (PEAK AT 9)                                       CHG00400
C                                                                         CHG00410
        DIURN = 0.5 * (1. + SIN(PI/12.*(LH-3)) )                          CHG00420
C                                                                         CHG00430
C***  RUN VARIATION (15 DAY CYCLE)                                        CHG00440
C                                                                         CHG00450
        RUNVAR = 0.25 * SIN(PI/180.*L) + 0.75                             CHG00460
C                                                                         CHG00470
C***  WIND SHIFT (ABOUT 180 DEGREES IN 12 HOURS)                          CHG00480
C                                                                         CHG00490
        DTH = 0.4 * SIN(PI/12.*LH)                                        CHG00500
```

```
C                                                                       CHG00510
        DO 90 K = 1,NRECEP                                              CHG00520
           X = RREC(K)                                                  CHG00530
           Y = SREC(K)                                                  CHG00540
C                                                                       CHG00550
C***   CARRY OUT WIND DIRECTION VARIATION                               CHG00560
C                                                                       CHG00570
           TH = ATAN2(Y,X) + DTH                                        CHG00580
           R = SQRT(X*X+Y*Y)                                            CHG00590
           X = R * COS(TH)                                              CHG00600
           Y = R * SIN(TH)                                              CHG00610
C                                                                       CHG00620
C***   CALCULATE CONCENTRATION (ELLIPTICAL PARABOLOID WITH              CHG00630
C***   VERTEX AT (0,2,260) )                                            CHG00640
C                                                                       CHG00650
           C = AMAX1(0.,25.*(4.-(Y-2.)**2) + 10.*(16.-X*X))             CHG00660
C                                                                       CHG00670
C***   INCLUDE MULTIPLIERS AND BASELINE                                 CHG00680
C                                                                       CHG00690
           PHCHI(K) = 1.E-06 * (BASE + DIURN * RUNVAR * C)              CHG00700
           RREC(K) = X                                                  CHG00710
           SREC(K) = Y                                                  CHG00720
 90      CONTINUE                                                       CHG00730
         WRITE(8)IDATE(2),LH,(PHCHI(J),J=1,NRECEP)                      CHG00740
         LH = LH + 1                                                    CHG00750
         IF (LH.LE.24) GO TO 100                                        CHG00760
            LH = 1                                                      CHG00770
            IDATE(2) = IDATE(2) + 1                                     CHG00780
100   CONTINUE                                                          CHG00790
C                                                                       CHG00800
C***   LIST GENERATED POSTPROCESSOR DATA                                CHG00810
C                                                                       CHG00820
      REWIND 8                                                          CHG00830
      READ(8)NPER,NAVG,LINE1,LINE2,LINE3                                CHG00840
      READ(8)NRECEP,(RREC(J),J=1,NRECEP),(SREC(J),J=1,NRECEP)           CHG00850
      WRITE(6,900)NPER,NAVG,LINE1,LINE2,LINE3,NRECEP,(RREC(I),SREC(I),  CHG00860
     .I=1,NRECEP)                                                       CHG00870
  900 FORMAT('1NPER,NAVG=',2I8/1X,20A4/1X,20A4/1X,20A4/' NRECEP=',I5/   CHG00880
     .20(2F10.1/))                                                      CHG00890
      DO 200 I=1,NPER                                                   CHG00900
         READ(8)IDATE(2),LH,(PHCHI(J),J=1,NRECEP)                       CHG00910
         WRITE(6,910)IDATE(2),LH,(PHCHI(J),J=1,NRECEP)                  CHG00920
  910    FORMAT(2I5,6P10F10.2/10X,10F10.2/)                             CHG00930
  200 CONTINUE                                                          CHG00940
      STOP                                                              CHG00950
      END                                                               CHG00960
```

Date_____

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I would like to receive future revisions to the "CHAVG User's Guide."

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